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SOME PROBLEMS CONCERNING THE MECHANISM OF LIGHT ACTION IN POULTRY

N. T. M. YEATES

Department of Livestock Husbandry, University of New England, Armidale, Australia

I. INTRODUCTION

Our recent investigations have been of two types:

(a) a comparison of different systems of lighting aimed at determining whether continuing increments of light act as a stronger stimulus to egg production than provision of a constant 14 hr. day;

(b) definition of the limit of effective light intensity for both morning and evening, in the natural day of the fowl.

II. LIGHTING SYSTEMS

(a) Experimental

The usual practice in commercial flocks, and that recommended by extension services (e.g. Moffatt 1957), aims at providing total daily illumination of about 14 hr., the implication being that this amount satisfies a threshold "requirement" of poultry for egg production.

Studies with other species (Yeates, 1949, 1956) suggest that change in length of day rather than absolute day length is effective in regulating photoperiodic response. To test whether this might also be so for poultry, an experiment was started in which egg production was compared in three separate groups receiving respectively (a) approximately 14 hr. light, (b) continuing increments of light, (c) natural light. White Leghorn x Australorp cross-bred birds were used.

Each treatment was applied to a pen of 175 pullets and a pen of 116 second year hens. Housing conditions and management were the same, except for lighting, in all pens.

(b) Results

Both artificial light treatments increased production above that of the untreated controls during the winter months, and both methods were about equally effective in doing so.

The following points emerged from the experiment:—

(i) The group receiving approximately 14 hr. light conformed to the usual pattern of production for this lighting system, i.e. it exhibited an early and substantial rise in production, followed thereafter by a steady decline.

(ii) Continuously applied light increments, even at high levels (e.g. 15 hr.), are unable to maintain an increasing production; indeed, after a time on such a regime production gradually declines.

(iii) An increase in the level of lighting seems to be most effective during the first few months it is applied following a period of decreasing light.

(iv) The fact that production started to increase as early as July among the controls (when light was at as low a level as 11 hr.) suggests that cessation of light decrements may be sufficient to stimulate laying. Certainly it shows that the concept of an absolute day length in the region of 14 hr. being "necessary" is fallacious. Hutchinson's (1956) findings appear to support this, though Hutchinson and Taylor (1957) refer to "adequate" absolute day length in their later paper, implying a threshold effect.

(c) Conclusion

Change in the level of light seems to constitute the effective stimulus, provided the pituitary is suitably conditioned. Unfortunately, such conditioning appears to involve periodical phases of low level lighting, and hence also intermittent periods of low production.

III. LIMITS OF EFFECTIVE LIGHTING

(a) Experimental

In this experiment* a flock of fowls maintained in a quiet, country location was observed night and morning approximately once a week, over a period of from five to six months, to determine the times at which the birds went up to their perches in the evening and came down in the morning.

(b) Results

Analysis of the results shows that the birds went to their perches when light intensity had decreased to approximately 1.5 ft. candles. Over the period of observations this corresponded to a time about half-an-hour before that described in the astronomical tables (Nautical Almanac) as evening "civil twilight". At civil twilight the sun has a depression of 6 degrees.

In the morning the birds came down from their perches approximately half-an-hour before morning civil twilight, so that light intensity was then much lower. Indeed, it was less

than 0.003 ft. candles, the minimum intensity to which the light meter was calibrated.

When morning and evening "perch times" were used as the basis for calculating the duration of "active day" for the fowls, this period was found to agree almost precisely with day-length determined as the interval between morning to evening civil twilight.

(c) Conclusion

Use of morning and evening civil twilight is recommended as a basis for determining day-length in photoperiodic studies with poultry. Such a system of calculating times has some biological basis and is less arbitrary than using sunrise and sunset as the limits of day-length. It must be appreciated, however, that the daily period of physical activity does not necessarily coincide with the photo-reactive period, and further studies are required to determine this latter more precisely.

* In preparation for publication.

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ARTIFICIAL LIGHTING AND EGG PRODUCTION

J. C. D. HUTCHINSON
C.S.I.R.O. Sheep Biology Laboratory, Prospect, N.S.W., Australia

I. INTRODUCTION

The advantage of an agricultural over a nomadic hunting economy has been not only in the increased supplies of food obtained, but also in a more even availability of food throughout the year. Consequently in agricultural research much effort has been expended in making yields less seasonal. In temperate climates the egg yield of fowls kept under natural conditions is low in winter and the object of artificial lighting has been to make production more even over the year.

II. EXPERIMENTS WITH ARTIFICIAL ILLUMINATION

Artificial light is said to have been first used by Spanish farmers. Later its efficacy was investigated in a number of

laboratories and it was found that it would prevent the winter pause of pullets and so increase winter production of eggs. The effect on annual yield was small, but since the price of eggs was high in winter, lighting was profitable to the farmer.

(a) Day Length

Various day-lengths were tried and it was found that 13-14 hours gave the best results. Continuous lighting, though just as effective in winter, usually resluted in a fall of production in spring.

(b) Wave Length

The effect of different wave-lengths on the reproductive activities of wild and domestic birds has been investigated. In general, red light has been found the most effective, but there would be no advantage in using coloured lights in farming practice, for the necessary intensity of white lights is low, being not more than 0.5 foot candles. Experiments at Beltsville, U.S.A., have suggested that ultraviolet light, used in combination with visual light, increases production, but this has not been confirmed in recent work.

(c) Flash Lighting

It has been found for many plants and animals that, if the night is broken by one or more short periods of light, this is equivalent to giving a long day-length, although the total number of hours of illumination may be small. This is true for hens and suggests that the length of the dark period may be as important as that of the light period. A commercial application of this principle is Staffe's flash lighting system. The significance of the high intensity used is not definitely known.

(d) General Management

Although light is important for egg production, pullets will come into lay when reared in complete darkness. However, with very short day-lengths production cannot reach a high level.

The effect of day-length during rearing on the age at first egg has in the past been a controversial question. Some work published recently from Reading University, England, seems to indicate that it depends upon the change of day-length from hatching to maturity. An upward change hastens the date of first egg, whereas a downward change delays it.

III. PRACTICAL USE

The practical effect of winter lighting combined with intensive housing can be gauged from British production records. In 1945, when range and fold systems predominated, and artificial lighting had scarcely come into use, the packing stations' returns of eggs in April were seven times as great as in November. In 1956, when the majority of birds were housed intensively, and lighting was in general use, the output of no month was greater than 50% above the minimum. The improved climatic conditions of intensive housing may have contributed to this change in the seasonal pattern of production, but probably not to an important degree.

Even when lighting is used there is a considerable seasonal variation in egg production in countries with temperate climates excepting the U.S.A. This is mainly because hatching is usually timed to bring most of the pullets into production in late summer or early autumn. At this time the old stock are cleared out and the new pullets are scarcely in lay, so that production must be low. Taylor and I were interested to find out what would happen in Britain if pullets were brought into lay in the early summer so that their maximum production would coincide with the national minimum. We suspected that production could be influenced by change in day-length as well as absolute day-length, and that the fall from high summer to the autumn equinox might inhibit winter production despite autumn and winter lighting. We obtained evidence that such a change could induce winter pausing in high latitudes.

IV. CONCLUSION

In New South Wales the returns of the Egg Marketing Board show that in October the weekly average of eggs received is nearly twice that for May and June. Even allowing for the fact that a considerable and constant number of eggs are sold directly at all seasons, this indicates much seasonal variation in production. It seems to be important to find out how far this is due to a restricted season of hatching, how far to the downward change of day-length from summer to the equinox, and whether Australian stock are less resistant to unfavourable environmental conditions for laying than American birds.

CANADA'S TURKEY PRODUCTION

P. A. KONDRA

Associate Professor, Poultry Department
University of Manitoba, Winnipeg, Man., Canada

During the past 40 years Canada's turkey population increased from slightly under 900,000 to 5,250,000 in 1957. This increase of 500 per cent is out of proportion to the 100 per cent increase in the human population during the same period. Hen and chicken population in the same period increased about 100 per cent. About one-half of the increase in turkey production occurred in the last 5 years. Canadian turkey meat consumption of 7.3 pounds per capita, dressed weight, in 1957 is probably the highest in the world. It is slightly more than one-half pound higher than that in the United States and is higher than the total poultry meat consumption of 7 pounds per capita in the United Kingdom.

The meat production role of the turkey was greatly enhanced by the introduction of the first Broad Breasted Bronze turkeys from England in 1927 by Jesse Throessel of Aldergrove, B.C. This new strain became the basis of practically all superior meat type turkeys grown on this continent. In addition, specialization and improvements in all phases of turkey production and processing, necessitated by economic conditions were jointly responsible for the rapid increase in turkeys. This, in turn, provided the consumer with a high quality product at competitive prices which resulted in the rapid increase in consumption from 2.8 pounds per capita in 1948 to 7.3 pounds in 1957.

In terms of dressed weight, Canada's turkey meat production of 107 million pounds in 1957 provided 6.3 pounds per capita which was 1 pound short of the actual per capita consumption. This shortage was taken care of, until recently, by imports from the United States which amounted to 17 per cent of domestic production in 1956. Because of restrictions necessitated by increased Canadian production, imports from the United States in 1958 were down to an insignificant figure. It should be realized that frequently the U.S. turkey meat surplus is greater than the total Canadian production.

Turkey production in Canada continues to increase. Poults hatched in 1958 totalled 26.6 per cent more than the previous year. Furthermore, there is some importation of

turkey poults from the States. The foregoing information reveals at least two important facts:—

1. With technical advancements, turkey meat production can increase very rapidly if the demand warrants.
2. Domestic production in 1959 will no doubt meet and probably even exceed domestic requirements at the present level of consumption.

REGIONAL COMPETITION

The greatest competition in turkey production will be within the industry itself as soon as the volume of production exceeds domestic requirements. This competition will intensify greatly commencing in 1959 because production is expected to approach a saturation point. It will be between grain growing vs. non-grain areas, and between commercial vs. mixed farm flocks.

Ontario and Quebec, a non-grain growing and highly populated industrial area, have had to utilize the latest technical knowledge and practice intensive specialized turkey production because of economic necessity. With about 60 per cent of Canada's population, they produced 48 per cent of the turkey meat tonnage in 1957. The three Prairie Provinces, with 18 per cent of the people, produced 43 per cent of the turkey meat in the same year. This situation has changed very little during the past decade; but in 1942 the Prairie Provinces grew 75 per cent of Canada's turkeys whereas Ontario and Quebec together grew 21 per cent. This was exclusively heavy turkeys and before commercial flocks became a significant factor in Canada's turkey production. Will history repeat itself, at least with regard to heavy turkeys? Mass production in Ontario and Quebec, with numerous flocks of 20 to 30 thousand or more birds, and group selling, will provide stiff competition to carlot sales whether from the Canadian Prairies or from the United States. Close proximity to markets is an added advantage of this region.

Regional competition will be determined by the availability and cost of grains and concentrates, the proximity to markets, and the availability and cost of labour and probably land. The Prairie Provinces have large supplies of grain which cannot be sold readily as such, but which can be marketed through poultry and livestock. Also, there are good supplies of protein supplements from the large meat-proc-

essing houses. Furthermore, mechanization of an agricultural production has greatly reduced labour requirements in the Prairie Provinces. The surplus of labour has difficulty finding employment in the relatively limited few industries located there. In addition to this, there are large areas of low-priced sub-marginal land in the Prairies which is suitable for range rearing of heavy turkeys.

Some of the recent developments on the Prairies indicate that they intend to take advantage of this situation. For example, a commercial turkey farm near Winnipeg has over 100,000 square feet of floor area in elaborate buildings suitable for the growing of light or heavy turkeys. In addition it has its own hatchery, breeding flock, and a modern processing plant. There are many flocks in the Prairies grown on pasture, ranging in size from 5,000 to 40,000 or more birds in each. At present there are 34 eviscerating plants in the Prairie Provinces, where none existed 12 years ago.

On the debit side of Prairie turkey production is the fact that this region will continue to be a turkey-surplus area, dependent largely on markets in Eastern Canada. Therefore, in addition to competing with Eastern products on the basis of quality, the Prairie producers will have to market their turkeys at a lower price because of transportation costs. This difference in price must be made up by the advantages named earlier. The fact that most of the feed grain used in Ontario and Quebec comes from the Prairies has not been a serious handicap to Eastern growers because of freight subsidies on Western feed grain shipped to Eastern Canada. This latter factor could be very important in deciding what region grows the bulk of Canadian turkeys.

Turkey production in British Columbia and in the Maritimes is limited to specialized flocks but their total production has been relatively small, having little effect on Canada's major markets.

TURKEY BROILERS

About 29 per cent of all poults hatched in Canada in 1958 were used for turkey broilers with about 90 per cent grown in Ontario and Quebec. Three years ago turkey broilers were practically unknown to the growers in Canada, which indicates a rapidly growing interest in this specialized intensive phase of turkey production, mostly in Eastern Canada.

Turkey broilers which weigh 7 to 8 pounds and which can

be used for roasting or frying should appeal to the average family. However, this phase of production in the States, which showed a similar expansion at first, has levelled off for two main reasons. First, in terms of cost of production per pound of meat, the turkey broiler cannot compete at present with the heavy birds, and second, most of the present stock does not finish well at the age of 13 to 15 weeks. With regard to the first point, the cost of the poult and brooding, excluding feed, are more or less fixed whether the bird is marketed at 8 pounds weight or at 20 pounds. These fixed costs amount to about 40 per cent of the total cost of a broiler, whereas they comprise about 20 per cent of the total cost of a heavy bird. Another development which may affect the future of the turkey broiler as a small roaster is the sale of quartered large turkeys as roasts approximating the weight of a turkey broiler. These are on the market in the United States, particularly in California. Furthermore, for frying or barbecues the turkey broiler is at present unable to compete with the chicken broiler, on the basis of cost and quality. In addition to the fixed costs named above there is a difference of about 20 per cent in feed conversion efficiency in favour of the chicken broiler. Regardless of the foregoing, many growers are very enthusiastic about turkey broiler production.

Ontario and Quebec, which grow most of the present turkey broilers, are well prepared to continue the lead in this intensive phase of turkey production. For instance, one grower near London, Ontario, is equipped to grow 100,000 turkey broilers in a year, plus 25,000 heavy whites, plus breeding and hatching capacity well beyond his own needs. He is also a feed dealer and has a small retail outlet which makes this set-up almost completely integrated. Specialized growers in British Columbia and in the Maritimes are prepared to take care of local needs, but their position is such that they have no significant effect on the major turkey broiler market.

The grain-growing Prairie Provinces shared less than 5 per cent of the broiler poults hatched in Canada in 1958; but there are many signs of enthusiasm over turkey broiler production. One broiler house recently completed at Boissevain, Manitoba, has 30,000 square feet of floor area under one roof. There are two smaller plants in the same grain-growing area. Furthermore, many newly built turkey broiler houses and livestock barns converted for this purpose may be seen in the

Red River Valley. Alberta, and to a lesser degree Saskatchewan, are showing similar developments, particularly around the large cities. It will not be long before the Prairies satisfy their own needs in turkey broilers. One of the limiting factors at present is the lack of off-season hatching eggs. Most of these eggs, as well as some poults, are at present imported from the States. The main competition in broiler growing in Canada will be between the specialized growers in Ontario and Quebec and those in the Prairies. Many of the factors discussed under "Regional Competition" will apply here as well.

SPECIALIZATION AND INTEGRATION VS. FARM FLOCK PRODUCTION

To date Canadian turkey growers have produced less than domestic requirements. But if the industry continues to expand at the present rate, over-production, keen competition and smaller margins are inevitable. This is likely to arise sooner than most growers expect. As margins decline growers must increase their output to maintain a high standard of living. It is the total net revenue on the entire operation that is important to the producer, rather than the net revenue per bird. In view of this, the more progressive and alert producers are taking steps to prepare themselves for the future situation. In addition to increasing the size of their flocks and employing fully the best management practices, turkey growers are also mechanizing all their operations including feeding, watering and cleaning so as to reduce production costs to a minimum.

Large-scale turkey raising requires a big investment as well as considerable risk. To minimize risk and to reduce capital investment large growers usually find it necessary to obtain supplies on credit, particularly feed and poults, and to make advance arrangements for marketing the stock. In many instances the same organization that supplies feed and poults also operates a processing plant. On the other hand, if the processor is to operate efficiently and turn out a high quality product at competitive prices, and thereby protect his own investment and that of the grower, he must have a steady supply of well grown birds. In order that all the phases of production be carried out efficiently, so as to produce a high quality product at reasonable cost, it is necessary to coordinate

or integrate the various agencies involved in hatching, growing, processing and marketing of turkeys. This is particularly important for year-round production. A happy medium can be attained by close cooperation and coordination of all branches, but with each branch of production being rewarded for its efficiency, so as to maintain the desired incentive so essential to progress.

How does the trend towards specialization and integration affect farm flock production? The small farm flock of 100 birds provides meat for home use and for a few friends, but it should not be considered a significant source of revenue for the farm family. Such small flocks usually take up valuable time of the farmer, which should be devoted to the larger and more profitable farm operations, so that in many instances it would be more economical to buy the few birds needed for home use. That this fact has been realized by many farmers is clearly indicated in the Prairie Provinces, where 24 per cent are listed as raising turkeys in 1946, whereas in 1957 the proportion had dropped to 11 per cent. This places the average flock size for this region at 91 birds.

Even flocks of 500 turkeys could hardly be considered economically sound. Yet, if turkey flocks averaged 500 birds each, it would take less than 2 per cent of the 268 thousand prairie farmers to grow their present output of 2½ million turkeys. In view of the fact that there is a fairly significant number of flocks of several thousand birds each, it is evident that there must be a large number of very small farm flocks. No doubt the trend towards fewer farmers raising turkeys will continue but it will not likely go below 5 per cent. This view is supported by experience in certain areas of the United States, where competition has been keen, which shows that on many farms whether a flock of turkeys is to be kept or not, and its size, are not decided on the basis of sound conventional economics. In most small farm flocks cost accounting is not done, and there is no clear evidence to indicate to such farmers at what price the birds must sell to realize a profit. Hence a fairly large number of farmers in the Prairies continue to keep small flocks. The total production of all these small flocks is large enough to create over-production which could depress the market, thereby endangering the welfare of the specialized producer who depends on this one enterprise for his livelihood.

COMPETITIVE FUTURE AND ITS REQUIREMENTS

Turkey meat production is expected to reach the saturation-point shortly. Export possibilities are not likely to be significant. Therefore, if expansion is to continue, it will depend, first, on the increase in human population and, second, on the increase in per capita consumption. According to the Gordon Royal Commission Report, Canada's human population is expected to increase by about ten million by 1980. At the present level of consumption this would warrant an increase of 73 million pounds of turkey meat in 22 years, or 3½ million pounds per year. This is a very small expansion in view of the fact that during the past 9 years turkey meat output increased on the average 8 million pounds per year. What is the status of the present per capita consumption in relation to future possibilities?

Turkey meat consumption in Canada, though higher than the States, is not subjected to as great competition as in that country, where chicken meat and red meat consumption is considerably higher than in Canada. On the other hand, turkey meat prices are a lot higher in Canada. In view of the fact that competition is likely to result in a decline in turkey meat prices, and that the Gordon Royal Commission forecasts a gain of 70 per cent in the income of the average Canadian by 1980, it is logical to suggest that turkey meat consumption may be expected to increase further, provided that it maintains a favourable competitive position in price and quality. Turkey meat can maintain a favourable competitive position with other meats but the industry must prepare to meet any competition through:—

1. Year-round production.
2. Improvement of stock by breeding.
3. Specialization and mechanization.
4. Coordination and integration of production.
5. Expansion of research.

1. YEAR-ROUND PRODUCTION

It is obvious that seasonal operation of different branches of the turkey industry, including hatching, growing and processing, does not permit efficient use of labour and materials. Furthermore, it does not lend itself to specialization and integration which are essential to low-cost production. Therefore, the most significant improvement in efficiency of production can be brought about by year-round hatching, grow-

ing, processing and marketing of turkeys. We have gone far beyond the seasonal state of production with chickens, and a similar trend is evident with turkeys. In 1953 3 per cent of the total Canadian poult production was hatched in the last 6 months, whereas in 1957 it was 11 per cent, and in 1958 17 per cent. Comparable figures for the same periods for Ontario and Quebec together are 6 per cent, 21 per cent and 30 per cent, respectively.

Year-round production requires control of environment throughout the year. The most important environmental factors are light, temperature and humidity. It is obvious that the brooding and growing of turkeys in cold weather requires control of temperature. This has led to well constructed and insulated brooder houses with central heating systems and thermostatic control. Furthermore, it is apparent that complete confinement of turkeys eliminates most of the climatic hazards and permits greater control of disease. Probably most significant of all is the need for control of environment, particularly light, for year-round production of hatching eggs. There is an urgent need and an opportunity for hatchery supply flocks to find ways of capitalizing on this recent development, as at present many of the eggs for off-season hatching are imported from the United States.

With spring hatched breeding stock, which completes its growth during the season of limited sunlight in the fall, it is an established practice to increase the light to about 13 hours daily commencing 4 to 6 weeks prior to the onset of reproduction. Recent trials have shown that fall- and winter-hatched breeding stock which completes its growth during the long summer days should have the light restricted to about 9 hours daily, commencing at about 22 weeks of age and continuing for 4 to 6 weeks prior to the onset of breeding. After the restricted light treatment, when light is gradually increased to about 15 hours, turkeys can be maintained in a normal breeding state during the fall and winter. This development has led to windowless houses for light control and complete insulation, and high capacity mechanical ventilation for temperature and humidity control during hot weather.

2. IMPROVEMENT OF STOCK BY BREEDING

Keen competition requires improvement of turkeys for reproductive performance. Per cent salable poults, hatched by

eggs set in registered hatcheries in Canada, was only 56.6 per cent in 1957 compared with 72 per cent salable chicks. Low fertility contributes considerably to this low hatch in turkeys. Egg production of heavy meat turkeys requires considerable improvement so that it may approach that of chickens to meet the needs of year-round production.

Research has shown that there is a significant relationship between high body weight, width of breast, and low reproductive performance within a strain, but most good meat-type strains have a small percentage of birds showing high reproductive performance. These exceptional individuals should be used to improve the strain. Since heritability of reproductive traits is relatively low, improvement can be accomplished only by means of a pedigree breeding program which enables selection of individuals for breeding from families showing high fertility, hatchability and egg production. But if selection, as is practised in most provincial hatchery supply flock programs, is made entirely for meat type, a highly heritable trait, then no improvement can be expected for reproductive traits.

Crossing of strains and breeds, which has meant so much to chicken production, should be applied to turkeys. Most of the crosses tested show varying degrees of improvement over the parent strains. Although single crosses show some advantage, the three-way cross is superior. It can be said that generally the female of the cross should possess high egg production and hatchability, whereas more emphasis should be placed on meat characteristics in the male parent. Of course the particular combination of strains must possess high fertility, which can only be revealed by making numerous crosses and observing the results. Crossing can be particularly helpful in solving the problem of low reproductive performance.

Another handicap in our present turkey stock is its lower feed conversion efficiency of about 20 per cent, even at the broiler stage in comparison with chicken broilers. Improvement of stock for early maturity and early market finish, so that heavy turkeys reach market at 20 to 22 weeks of age, would reduce costs considerably. Another problem of turkey broiler production is the insufficient fat at 13 to 15 weeks of age. It should be the objective of the breeder to select stock which will show good finish, both at the broiler stage and at maturity, so that the grower could meet changing seasonal

demands of the market. There is a noticeable trend towards the use of turkeys with white plumage colour to overcome the problems of "blue-backs" and pin feathers but most of the present heavy whites need improvement for growth rate and early finish. Early feathering, which is a definite advantage in chickens, requires improvement in turkeys. In general, it can be said that intensification of turkey breeding work is greatly needed to approach the stage reached by chicken breeders.

3. SPECIALIZATION AND MECHANIZATION

It is practically impossible to find an individual, including the farmer, who will be qualified to apply himself efficiently to three or four different undertakings on a mixed farm. Knowledge and labour can be utilized most effectively by specializing in turkey production on a scale large enough to justify full mechanization. For example, it is reported that at a completely mechanized ranch near Fresno, California, one man takes care of 106,000 turkeys from 8 to 26 weeks of age. There could be no comparison in labour costs of this specialized and mechanized ranch with a small farm flock operation.

4. COORDINATION AND INTEGRATION OF PRODUCTION

Efficient production requires coordination of all branches of the turkey industry including breeding, hatching, growing, processing and merchandising on a year-round basis. This cannot be done by each branch independently but requires coordinated planning and direction by an authoritative and competent body which is well versed in all the technical and practical aspects of production, from the grower to the consumer, including the necessary financing. In addition to providing continuous supply at reasonable cost, some form of integration is necessary to maintain quality control at the grower level through the use of the latest technical information.

5. INCREASED RESEARCH

At present research in various phases of turkey production is very limited. There are many problems that require urgent attention through research in breeding, nutrition and control of physical environment.

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TEMPERATURE AND NUTRITION

W. F. O'ROURKE
Tioga Mills Inc., Box 150, Waverly, N. Y.

GROWING POULTRY

Metabolism studies by Barott and Pringle[1] clearly outlined the optimal temperatures for growth and feed efficiency when oxygen consumption was used as the criterion. In subsequent work by these same investigators[2,3,4] growth and feed efficiency were determined for various temperatures over the first 32 days of the chick's life. Optimum growth was obtained at 94-95°F for the first day and decreased to 88-87°F by the ninth; a further drop to 80F° by the 18th day and 66° by the 32nd day. Growing the chickens at any temperature other than optimum on the 32nd day influenced growth rate less than if the same variation from the optimum occurred at an earlier age, demonstrating improved heat regulation of the older chicken.

Recent work reported by Combs[5] emphasizes the effect of temperature on growth and feed efficiency of broilers. Data from this work is shown in Table I.

TABLE I

Effect of Temperature on Growth of Chickens

Feeding Program	Ad Lib.	Pair Fed to Consumption 75°F Birds	Ad Lib.
Experiment 1			
Temperature (°F)	50	50	75
Ave. gain 5-8 wks. (grms)	411	398	529
Feed efficiency 5-8 wks.	2.88	2.78	2.09
Experiment 2			
Feeding Program	Ad Lib.	Ad Lib.	Ad Lib.
Temperature (°F)	60	75	90
Ave. grain (period unknown)	794	782	575
Feed efficiency	2.21	2.16	2.28

The University of Connecticut has similar unpublished work. Dr. Potter provided data for the 1957-58 tests. This is shown in Table II.

TABLE II

Effect of Temperature on Growth of Chickens

Temperature	Chick Performance (4-8 weeks) 45°F	65°F
Feed consumed, pounds	6.95	6.30
Body weight	3.37	3.44
Feed efficiency	0.325	0.370

Mills[6] concluded that the chicks thiamine and pyridoxine requirement was four times greater at 91°F than at 68°F, however, Mills et al.[7] reported no differences attributable to temperature on the requirement for pyridoxine, niacin, folic acid, biotin or choline. They did conclude that thiamine required at a higher temperature was greater than at a lower temperature. However, the mortality from other causes than thiamine deficiency casts doubt on the conclusions reached.

In a continuation of work on vitamin and protein levels with growing birds exposed to 99°F temperature for seven days, Squibb et al.[8] observed in contrast to their rat work, no reduction in serum levels of total protein, riboflavin, ascorbic acid or vitamin A. Feed intake was reduced and they postulated that with a long term experiment, some reduction in these serum components might be expected.

Thornton[9] working with progeny of ascorbic acid supplemented hens observed better bone ash at two weeks but not at four weeks and better growth than progeny from non-supplemented hens when the chickens were produced in the summer time but not when the chicks were produced in the winter. In addition ascorbic acid increased the growth rate of Leghorn chicks in the summer but not in the winter and not at all with broiler chicks.

An observation of temperature effect on vitamin requirements of turkeys was reported by Dunkelgod et al.[10] On a high protein-high fat highly fortified turkey ration frank deficiency symptoms were observed in the summer but not in the winter. Winter poults injected with pyridoxine, biotin and thiamine grew faster than the uninjected controls.

The relative grain and mash of growing turkeys as influenced by weather was the subject of a report by Almquist.[11] He observed that during the cold weather of fall and winter, grain constituted a larger proportion of the daily diet than during warm weather. When this disproportionate grain consumption was induced by cold weather, an effect on growth was not observed in mature turkeys, but some growth depression was seen with young Broad Breasted Bronze toms. Almquist postulated that this reduction in gain was due to excessive grain consumption which thereby reduced mash consumption below the nutrient level necessary for maximum growth.

Bruins[12] made an interesting observation on the survival

rate of replacement pullets subjected to severe natural heat stress. He compared the survival of pullets reared on restricted energy intake and those reared on full energy intake. Pullets on either program that had been in production (and on full feed) for a relatively long period of time died at the same rate. The restricted fed birds that had just been placed on full feeding suffered less mortality than their sisters reared on a full feeding program.

The use of tranquilizers at various temperatures may be of interest. Huston[13] has conducted some experiments with growing birds using reserpine in the ration. This compound slightly improved growth of birds maintained at an ambient air temperature of 86°F. No effect was noticed at 70°F. The birds at 86°F consumed more oxygen per unit of body weight than the 70°F birds but when Serpasil was included lower body temperature and oxygen consumption were noticed for the 86°F birds.

LAYING HENS

Considerable research activity in the past two years has been aimed at establishing parameters for heat resistance of various breeds of layers, the influence of diurnal temperature rhythms, reproductive state and temperature stress, and relation of season to the resistance to heat stress.

In general, the light breeds are more resistant to high environmental temperatures as shown by Huston et al.[14] 70° temperature caused a severe drop in production with New Hampshire and White Plymouth Rock Layers but not Leghorns. Of particular interest was the influence of temperature on feed efficiency of the Leghorns held at 90°F as compared to Leghorn hens in a variable temperature environment that ranged from 43-62°F. The production of both groups was 66% and feed per dozen eggs was 3.32 and 4.59 lbs. respectively.

Squibb et al.[15,16] conducted experiments where in the daytime temperatures produced heat stress and night time temperatures were cool. Even though heat stress was evident during the day, no drop in production occurred and production was maintained at the same high level as birds housed at more salubrious locations.

Decreased feed intake is suggested by Weiss[17] as the reason nonlayers withstand lethal high temperatures better than layers. In either layers or nonlayers survival time was increased by previous experience with warm temperatures.

Another experiment that is not absolutely relevant to the current discussion but that has connotations of interest was conducted by Greenwood[18] in Scotland. He placed 18 hens and one male in a constant environment climatic chamber and 18 more hens and one male in a variable temperature environment. The experiment ran for six years and the following was observed.

The birds in the variable climate winter paused and molted like normally housed hens and responded production-wise as would be expected. The constant climate birds reached 80% production and stayed in production without molting or long production gaps for three years. Egg production declined over the three years. Of possible interest to the nutritionist is the observation that while hatchability remained at above 80% for four years with the variable climate birds the hatchability of the constant climate birds decreased over the four years from 84% to 67% to 42% to 34%. Also no deaths were observed until the birds were 3½ years old. Since that age, all but one of the constant climate birds died while only two of the variable climate birds died and one of those by accident.

Hill et al.[19,20] presented evidence and calculations on the effect of energy concentration on production and production efficiency. The energy concentration during the winter needed to be considerably higher for optimum production than the energy concentration during the fall and summer. In predicting feed consumption by the use of Byerly's partition equation, it was calculated that over-estimation would occur in the fall and summer and under-estimation in the winter in a climate comparable to that occurring in their experiments.

Singsen et al.[21] have estimated the feed consumption of heavy breed hens for a controlled feeding program. One of their considerations in the use of partition equation to estimate feed consumption was the effect of season on energy requirements. The practical necessity of having to use the time of year rather than individual housing conditions creates difficulty in estimations from farm to farm.

Ascorbic acid has been shown to improve shell quality when birds that have been housed in a variable climate (70-75°F) were transferred to a climatic chamber with an environmental temperature of 83-84°F by Thornton et al.[22,23] In a third report[24] when ascorbic acid was given to birds already in a warm environment, no improvement in shell

quality was observed although interior egg quality was better. When the technique of moving the hens from the relatively cool climate to the warm climate was employed as in previous experiments, ascorbic acid again prevented reduction in shell thickness.

An interesting series of experiments on shell quality and calcium levels was reported at the Annual Poultry Science Meeting by Peterson et al.[25] They reported there was less reduction in shell thickness, as housing temperature was increased, of eggs from hens receiving 4.5 and 5.25% calcium in the ration.

Tranquilizers have been studied with layers with mixed results which are somewhat dependent on the amount of heat to which the hens were subjected. Gilbreath et al[26] in observing the effect of reserpine on egg weight and shell thickness during naturally occurring periods of high temperature reported improvement. Anderson and Smyth[27] observed no improvement of egg quality when hens were taken from 70° to 90°F with reserpine but did observe that reserpine prevented loss of body weight. Weiss[28] used high (105°F) lethal temperature and concluded that Serpasil was beneficial when length of survival was the criterion. This substantiated the work of Burger[29] who also observed better production of the reserpine supplemented birds immediately following high temperature.

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EVALUATION OF NEW DRUGS IN POULTRY FEEDS

R. A. RASMUSSEN

Peter Hand Foundation, 1000 W. North Ave., Chicago 22, Illinois

I. ANTIBIOTICS

a. Potentiation in Poultry. Many papers have been published indicating that the blood level of an antibiotic can be increased by the feeding of terephthalic acid. Sera erythromycin and oxytetracycline were increased more than two-fold when 175 ppm of antibiotic and 0.3% of terephthalic aicd were used with two to three-week-old chicks.[1] Chlortetracycline fed to laying hens at the rate of 1000 grams per ton of feed with 0.5% added terephthalic acid increased the absorption of the antibiotic in the blood, egg white, egg yolk, liver, light meat and dark meat.[2] The value of potentiation of antibiotics in treatment of disease has been shown for chlortetracycline and oxytetracycline[3,4] and chlortetracycline[5] alone.

Although terephthalic acid can possibly be used in treatment of disease its general feed use has not been cleared through F.D.A. An approach that is offered is in lowering dietary calcium levels[6] wherein a low calcium diet (0.35% Ca) increased serum Aureomycin levels about six-fold in four-week-old chicks at a dietary level of 200 ppm fed for three days. The low level of calcium could be fed for 28 days without any marked growth reduction. While the low levels of calcium can be used with broilers and replacement chicks, the problem is more complex with adult chickens and turkeys. The greater requirement for calcium with layers and breeders in production could result in calcium tetany if a low calcium diet were fed for any appreciable period of time. Early morning feeding of a low calcium ration or the use of calcium sulfate and phosphorus acid are offering a possible solution for potentiation with mature birds.

b. Growth responses. In four chick growth studies penicillin G produced a small response in three out of four trials, with penicillin V a small response was secured in one out of two trials, while in all four experiments, erythromycin produced 4.9% to 7.7% increase over controls, inclusion of spontin in one trial produced a growth response of 8.2% over controls.[9] It was postulated that the continued use of penicillin G in the Laboratory had resulted in development of resistant microorganisms.

The daily gains of pigs fed Hygromycin or chlortetra-

cycline in drylot rations were increased during the period from weaning to 100 pounds, and a synergistic effect was produced when both were fed. During the later growth phase (100-200 lbs.) the greatest growth response was obtained when pigs were fed chlortetracycline alone. Hygromycin appeared to reduce feed consumption and in some cases rate of gain during this period.[9]

With lambs, injecting or implanting antibiotics into newborn lambs did not affect early death loss or early weight gains.[10]

The value of antibiotics for growth stimulation appears to be related to the particular conditions. In many instances with poultry, swine and dairy calves the usefulness of a particular antibiotic appears to decrease with continuous usage, and many times changing to a different antibiotic increases antibiotic effectiveness.

II. TRANQUILIZERS

Practical use of these compounds in quieting nervous animals for veterinary examination or during periods when flighty birds are to be moved to new quarters has been demonstrated.

Considerable, deviation between experimenters has been encountered in the use of tranquilizers for growth stimulation. In a study involving three trials and 800 cockerels levels of reserpine as high as 25 mgms. per kg. diet did not appear to have any effect on growth, feed consumption, mortality, or social conduct.[11] While no positive response to reserpine was secured with a slow growing White Leghorn strain, a more rapid growing broiler strain-cross exhibited marked growth response to a low level of reserpine, but only with female chicks.[12] Slight but significant increases in growth were reported in chick experiments with White Leghorn chicks but not with New Hampshire chicks when Chlorpromazine was fed. Reserpine produced slight but significant gains in White Leghorn chicks and significant growth of turkey poults.[13] In egg production a low level of reserpine (Serpasil) supported egg weight and shell quality during periods of relatively high temperatures on less feed; however, these treated birds produced fewer eggs.[14]

It appears that much more work is necessary before it can be definitely stated that tranquilizers will consistently increase weight gains when fed to livestock or poultry.

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COMPARISON OF CERTAIN SYSTEMS FOR FEEDING TURKEYS ON RANGE

H. J. ALMQUIST

The Grange Company, Modesto, California

The following discussion applies to the feeding of turkeys after they are removed from brooder houses and, customarily, are placed in pens in the field for the growing period. While it is sometimes called "range" the environment implied in this case is actually dry lot since the birds get no pasture. They are, instead fed a manufactured or formula feed (FF) which contains supplementary proteins, minerals, and vitamins and more or less ground grain, prepared as a mash or pellet, and they may also have separate access to whole grain, which will be referred to as "grain" in the present discussion.

Early studies[1] of the comparative intakes of FF and grain by large and small turkeys, of both sexes, having unlimited access to both feeds showed the following:

a. FF intake curves closely resembled the growth curves of hens and toms of the two varieties, both as to shape and spread. The hen consumed little more than half as much FF as the tom. On the other hand, the grain intake curves of hens and toms of the same variety were similar and close together.

At the later ages the grain intake showed a rapid rate of increase while the FF intake remained constant or showed a gradual decrease.

b. FF intake in the early growing stages was almost identical per pound of body weight of turkey regardless of sex or variety.

c. Total feed eaten per pound of body weight started at an identical point and kept on a similar path until each kind of bird attained about two-thirds of adult weight, at which time the feed conversion rapidly became poorer.

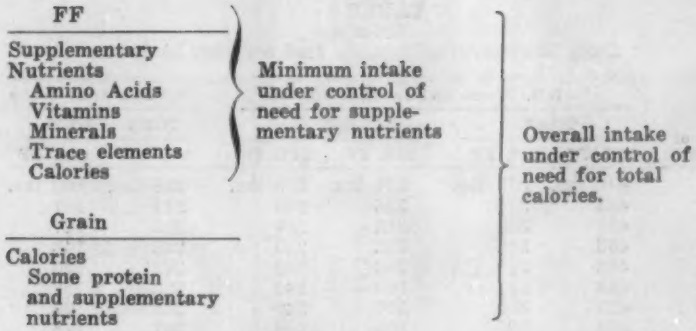
In a further study (2) it was observed that large and small varieties of turkeys showed a tendency to eat somewhat more FF in cooler weather, however grain intake showed large variations (up to 300% increases) from warm to cold seasons. Sudden fluctuations in daily temperatures were accompanied by sudden changes in daily grain intake, but hardly any sudden changes in FF intake.

The voluntary grain intakes for toms and hens of the same variety and ages remained only moderately heavier for the tom, but his FF intake remained much higher than that of the hen, showing a marked sex difference in the urge to secure the supplementary nutrients.

In later investigations (3) involving "free-choice"* feeding of various FF and various grain combinations, with various caloric values of each type of feed, it was observed that the total caloric intakes of turkeys, estimated from tables of productive energy turned out to be closely similar for the same sex, when calculated as "caloric efficiency of gain", i.e. weight gain divided by caloric intake. It was evident that given a wide variety of diets the healthy turkey has the ability to regulate daily caloric intake closely, and can be stopped from so doing only by extreme conditions or deprivation of feed. At the same time there was good evidence that a subordinate control was manifest in regard to intake of FF, there being a definite need for the supplementary nutrients manifest by a voluntary selection of at least a minimum required amount of FF daily. The situation is expressed in the diagram on the next page.

It was apparent that the birds might consume somewhat more of the FF than the minimum required, since in the search for additional calories the bird might eat either FF or grain. Under urgent need for calories, as in very cold weather,

* Provision of both FF and grain without limit.



the bird might prefer the grain if it was a more concentrated source of calories than FF, however some expensive FF was usually wasted as a source of calories, which could have been provided more economically as grain.

To avoid this waste a system of feeding was devised which consisted in giving limited amounts of FF per bird daily, while offering unlimited access to grain. It will be evident that this is not a "restricted" feeding program in the usual sense that the bird has no feed of any kind available for certain periods. Rather we have called it an "allowance" feeding program to indicate definite quotas of FF daily but no restriction on grain intake.

Extensive field trials were conducted with various levels of FF and with various grains. The FF used for the most part was a 20% and a 24% protein pellet carefully formulated to meet the known nutritional requirements when consumed at the tested daily allowances. A wide range of allowances was studied, some of which proved too small and some unnecessarily large. As a result the following schedules of allowances of FF were arrived at (Table 1).

As an alternate method of limiting the amount of FF consumed, daily trials were made by leaving the pellet feeders open a specified time each day and then closing them, allowing the birds access only to grain for the remainder of the day. The pellet feeders were opened at 7 a.m. and closed as indicated in Table 2.

An interesting fact, as shown in Table 2 and found in other trials was that the birds would consume the daily allowance of pellets, and slightly more, within the 2-hour period of access to a 24% pellet. When the feeder remained open another hour the birds consumed but very little more pellets. It was

TABLE 1

Daily allowances of formula feed per 1000 birds

Week of Life	B.B. Bronze and Large White				Beltville Small White	
	TOMS		HENS		TOMS	HENS
	20% FF	24% FF	20% FF	24% FF	24% FF	24% FF
11	440 lbs.	372 lbs.	338 lbs.	270 lbs.	213 lbs.	160 lbs.
12	445	376	325	260	217	162
13	450	380	312	250	222	157
14	456	385	312	250	222	148
15	462	390	300	240	222	140
16	468	395	300	240	222	130
17	473	400	300	240	214	120
18	468	395	300	240	187	112
19	456	385	290	230		
20	445	375	290	230		
21	438	370	290	230		
22	438	370	290	230		
23	438	370				
24	426	360				
25	426	360				
26	414	350				

noted that when the birds had 2 hours access to FF they seemed to be satisfied, did not unduly crowd the pellet feeders at the next feeding and made good and uniform development. The weights attained were equivalent throughout. The feeding economy, however was in favor of the feeding according to the allowance tables.

It was necessary for the caretaker to make a second trip daily to all feeders to close them at the proper time. It seems possible that a mechanical feeder might solve this extra work problem.

In Table 3 are given results of a field trial in which free-choice, allowance and 36% concentrate feeding were compared. The latter concentrate was mixed with whole barley and fed as a single mixture according to a currently advocated program.

The results indicated in favor of the allowance feeding program in respect to revenue per bird in excess of feed cost. In Table 4 are given typical carcass grade and yield results as obtained from a processor. These data indicate little or no difference in grade and yield results from two feeding systems, which differed only in the manner of feeding.

In Table 5 are shown some comparative results with two grains and two levels of allowance feeding of FF. This table illustrates typical findings. While weight gains were somewhat depressed when the birds were finished out on barley

TABLE 2

Some comparative results with time limited feeding of formula feeds.
B.B. Bronze. Winter season.
300 birds per pen.

Formula Feed	Time Limit on FF	Pellets per Bird		Milo Grain per Bird		Weight at Sale*		Feed Cost per lb. Live Weight †	
		Toms	Hens	Toms	Hens	Toms	Hens	Toms	Hens
20% protein pellet	none	50.6 lbs.	22.4 lbs.	26.7 lbs.	17.0 lbs.	25.1 lbs.	14.2 lbs.	15.9¢	15.8¢
24% protein pellet	3 hrs. daily	42.4	18.4	34.8	20.9	25.1	14.2	15.6	15.5
24% protein pellet	2 hrs. daily	41.0	17.8	35.0	21.2	25.1	14.1	15.3	15.4
24% protein pellet	Allowance No time limit	37.0	15.3	35.2	21.7	24.6	13.9	14.7	14.8

* Toms sold at 25 weeks
Hens sold at 22 weeks
† Includes cost of starter feeds

TABLE 3

Some comparative results from free-choice, allowance, and concentrate-grain mixture systems of feeding range turkeys. B.B. Bronze. 300 birds per pen.

Formula Feed	Grain	FF per bird		Grain per bird		Weight at Sale *		Feed Cost per lb. of Gain		Value of Weight Gain —Less feed Cost	
		Toms	Hens	Toms	Hens	Toms	Hens	Toms	Hens	Toms	Hens
20% protein pellet, free-choice	Milo	54.7 lbs.	24.2 lbs.	10.4 lbs.	10.9 lbs.	24.7 lbs.	14.0 lbs.	19.9¢	23.2¢	88.3¢	28.9¢
20% protein pellet, allowance	Milo	44.1	22.9	15.8	11.6	24.0	13.9	17.7	20.9	116.6	45.9
24% protein pellet, free-choice	Milo	46.8	20.7	17.3	12.7	24.9	13.8	19.3	22.9	97.5	29.6
36% protein concentrate (mixed with whole barley)	Barley	14.5	8.6	47.2	24.4	21.4	13.0	18.0	20.1	92.2	44.4

* Toms sold at 25 weeks
Hens sold at 23 weeks

TABLE 4

Grade and yield results

FF	Grain	Carcass Grade				Dressing Yield	
		A Grade		B Grade			
		Toms	Hens	Toms	Hens	Toms	Hens
20% protein pellet –free-choice	Milo	92.8	84.0	7.2	16.0	78.7	81.2
20% protein pellet –allowance	Milo	90.6	86.7	9.4	13.3	81.1	80.7

TABLE 5

Comparative results from range feeding of milo and barley with allowances of FF

20% protein FF daily	Total FF per bird	Grain per bird	Kind of grain	Weight Gain	Caloric Efficiency of Gain*
		B.B.B. Toms 12-26 weeks			
0.50 lbs.	50.99 lbs.	34.99 lbs.	Milo	18.28 lbs.	.161
0.50	49.19	34.49	Barley	17.78	.163
0.45	44.79	35.79	Milo	17.85	.166
0.45	44.68	39.78	Barley	17.37	.167
		B.B.B. Hens 12-24 weeks			
0.30	24.75	22.46	Milo	8.04	.127
0.30	25.11	21.59	Barley	7.22	.125
0.25	21.52	23.37	Milo	7.43	.122
0.25	21.94	23.73	Barley	6.98	.123

* Weight gain x 1000 divided by total caloric intake in productive energy.

as compared to milo, it is a striking fact that caloric efficiency of gain remained very similar for the two grains in all comparisons. This shows, once again, that the turkey can regulate caloric intake very closely, although growth rates may be affected by causes other than availability of calories. We have observed in studies with a variety of grains that when caloric intake via FF is limited, the turkey will usually select amounts of various grains in inverse order of the caloric values of these grains.

Attempts were made to work out allowances of FF which contained more than 24 percent protein. These attempts ran into difficulty in that the daily quotas of FF given the birds were too small and caused uneven intake due to the stronger birds getting their fill and not leaving enough for the others.

Excessive crowding at the feeders resulted. A 24% protein FF appeared to be near the upper limit of protein content for this system. Obviously, this FF must be carefully formulated to provide all supplementary nutrients required at the specified allowances for feeding.

At the 24% protein level, the birds seemed at times to wait for the FF and to rush the feeders at feeding time. This problem was solved by giving a 10% increase in allowance for a few days, after which the regular allowances were resumed without difficulty. It should be kept in mind that the presented tables are based upon average good turkeys, and that a larger or faster growing bird might require correspondingly higher allowances.

Discussion of this system of feeding would not be complete without consideration of its advantages and disadvantages in comparison to other systems.

ADVANTAGES

1. The allowance system is capable of growing a uniform, well-finished turkey on the least amount of FF. This reduces manufacturing costs on feed to a minimum.
2. The allowance system permits the grower to obtain or grow his own grain and may reduce hauling charges on grain which in complete feed or "all-in-one" systems must be put through a feed mill before delivery.
3. Like the free-choice feeding of FF and grain, the allowance system requires only one FF for the entire range growing operation.
4. Like the free-choice system, the allowance system permits the turkey to make immediate and economic changes in caloric intake to meet changes in requirement due to weather, season and development.
5. The allowance system is superior to free-choice in that it makes almost any grain work well. The filling of grain feeders need not be on a daily basis.
6. The allowance system emphasizes good feeding management and daily observation of the birds. The grower is quickly aware when birds are beginning to go "off feed" for any reason.
7. The allowance system is convenient for the giving of medicated feed.

DISADVANTAGES

1. The allowance feeding requires a method of measuring

feed, either by weight or bulk. This measuring many growers are unwilling to do, especially when feed is delivered in large bulk consignments.

2. The allowance feeding requires daily feedings and is incompatible with programs using range storage feeders to be filled perhaps only once or twice per week.
3. The allowance feeding system requires close information on the numbers, sex and losses of birds in any feeding unit, in order that the correct daily amount of feed can be calculated. This information and arithmetic many growers are reluctant to contend with.
4. The allowance feeding system may require more labor cost in the feeding of large flocks. In the case of small flocks, the caretakers may be able to devote this extra time, and therby pay themselves a good return in feed costs saved.

As a final comment, it might be said that the most unpopular feature of the allowance system of feeding has been, in effect, the good management required to run the program. It cannot be made to give good results without good management and should not be considered when such management may be lacking.

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AN OPEN RANGE SYSTEM OF POULTRY FARMING FOR NORTHERN NIGERIA

V. R. KASCHULA*

Veterinary Laboratory, Private Bag 28, Kaduna, Nigeria

Most poultry in Nigeria are kept on a free range system of husbandry but they receive little attention by their owner. The birds largely look after themselves. This is because of their good self-feeding and scavenging ability and breeding

* Employee of International Development Services, Inc., New York 20, N. Y. Seconded to the North Region of Nigeria Veterinary Department since September 15, 1957.

characteristics and the low production potential of the birds. No serious effort is made to feed these birds and if they are fed at all, they only receive what amounts to a maintenance ration.

Most of these flocks are in the villages. If poultry in the villages are to be fed properly, and if they are to be isolated for production and husbandry purposes and from diseases it is necessary to build a good fence. The most satisfactory is a wire mesh fence. The moment a fence is placed around the birds they are isolated from other birds but they are denied the unquestionable benefits of free range and have to be provided greens from a garden which is often a difficult matter especially in the dry season.

Recently small improved poultry flocks have been placed in isolated farm compounds which are not in the villages and the birds were not confined within a fence. These compounds were isolated at least several hundred yards from their nearest neighbour. All female native stock was removed and the males were caponised chemically, so that in a short while all stock was of imported stock. Housing was so designed that birds could range freely in and around the compound but the eggs were laid inside the poultry house, access being gained through a small "chicken door" 12″ x 9″. The main door of the house was locked enabling the farmer to be away from his compound all day without fear of theft of his eggs and he could collect them when he returned home. At night the birds were locked up making them safe from predators and thieves.

The basic principle of this system is to have a small "chicken door" 12″ x 9″, only small enough to admit the fowls when open but the main doors remain locked. See Fig. 1. Birds can enter and leave at free will while humans cannot enter because the passage is too small. The farmer can collect his eggs at the end of the day without fear of losing any during the day. The fowls receive an ad lib. supply of properly balanced mash which is placed within the house. This prevents goats and other animals from devouring it, but if attendants are available the food and water are placed under the shade of a tree or other suitable place.

Two types of housing are being employed, namely a native mud hut with thatched roof for permanent residents (see Fig. 2) and an aluminum pan shelter built on a light wooden frame. This should be so constructed that eight bolts hold it together and it can be dismantled for ease of transportation.

Fig. 1. The small "chicken door", 12 x 9 inches, which is just large enough to admit the fowls when open but too small to admit a human. The larger door can therefore be locked and yet the birds have freedom of exit or entry into their house.

Fig. 2. Round native mud hut fitted with a "chicken door". Notice the mud hut is located away from the Moslem compound on the left, enabling the birds to free range in the immediate vicinity of the hut.

This type of housing is particularly suitable for nomadic peoples like the Fulani. (Fig. 3). In both of these houses the small "chicken door" as mentioned above are an essential feature.

Fig. 3. The aluminum portable house showing the interior. Perches accommodate 20 - 25 birds. The house is light, so bolted together that it can be dismantled, uses the small chicken door, and all doors can be locked making the birds safe from predators and thieves. The house is located in a shaded spot, preferably under a tree.

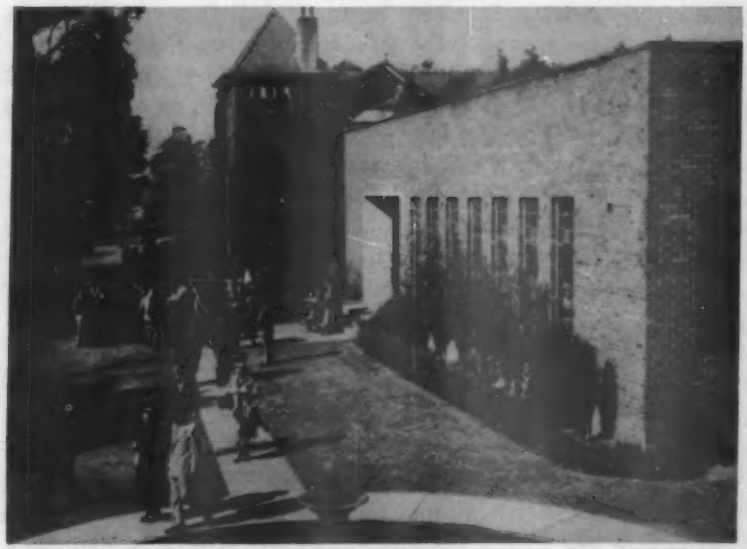
Free ranging of birds has not only reduced the overhead cost of equipment but several vexing problems which are especially troublesome in the tropics have been eliminated. These are vices such as cannibalism and egg and feather eating. The need for green food which should be supplied in addition to the balanced ration is also obviated. Birds kept on free range have been much happier, their production has been much better and the size and appearance of the eggs were improved. Furthermore because of the essential isolation from other birds disease control should be much easier. In addition control of thieving is accomplished in a satisfactory manner.

EGG LAYING COMPETITIONS

V. H. M. BRANN
Poultry Expert for the State of New South Wales - Australia

Changing methods of poultry production, labour saving devices, applied breeding and a greater degree of mechanisation have brought to an end those days when egg laying competitions were regarded as vital to industry efficiency. Breeders of many years standing, listening to a discussion on the science of breeding, would recall the days when breeding better birds meant little more than a fancy for some particular type of fowl.

A controversy in the columns of the press between two breeders on the merits of Buff Orpingtons and Silver Wyandottes started the Hawkesbury Agricultural College Egg Laying Competition in 1901. It was the first test in the world conducted over a full year and attracted remarkable support, including Rose Comb Brown Leghorns from the United States of America. The first six Langshan pullets, being the progeny from birds imported direct from Shanghai, laid



View of Administration Block at Hawkesbury Agricultural College, Sydney, where the world's first Egg Laying Competitions were held in 1901. The War Memorial Library is in the foreground.

1,481 eggs in the sixth egg laying test. Really good egg averages on present day standards were fairly common and within ten years there was a general acceptance that the public testing of poultry had proved the greatest educational force in the poultry industry.

At the beginning of this century it was said that the number of people making a living from poultry farming in New South Wales could be counted upon the fingers of the hands. Within ten years of the inauguration of the Egg Laying Competition there were many hundreds of people producing eggs as a full time occupation. Within a few years competitions were being conducted in all States and indeed in many foreign countries. A number of poultry Associations commenced independent competitions for their members.

The first effect of the competitions was a decline in the number of breeds kept by thousands of suburban fanciers who supplied the consumer with most of the fresh eggs obtainable in those days. Most consistent prize winners were White Leghorn, Black Orpington and Langshan. The Rhode Island Red was a later creation and the Orpington went through a process of evolution to improve the general-purpose qualities and emerged as the Australorp which commenced to break egg laying records in many competitions. Older poultrymen point to these records of over 300 eggs per bird in a year and question whether science has achieved any improvement at all! Firstly the breeds giving the high records had the virility of recent creation. They possessed the imparted vigour of cross breeds. With a new knowledge of nutrition spectacular results were obtained by the feeding of balanced rations, providing better environmental conditions and testing was confined to first season birds. In more recent years no improvement in egg averages was obtained in the different egg laying competitions. Cross breeding became a modern trend to improve commercial flock averages and with the universal demand for crossbred stock selective breeding became almost a neglected phase of poultry farming.

THE HATCHERY TRADE

The introduction of agitated air incubation started an era of higher specialisation. Chickens could be supplied in large batches to egg producers and consigned over long distances. This cut down the number of breeders and competitors eligible to compete in egg laying tests. Probably 80 per cent. of chickens raised on commercial poultry farms in Australia

are from less than 100 hatcheries and not all of these are breeders in the strict sense of the word.

The falling interest in the egg laying competitions is not due to the obvious weaknesses of a system testing a mere few pullets from each breeder but is the result of the decline in the number of breeders eligible to compete. The element of sportsmanship in any contest is still very strong and while egg laying competitions have lost support from a dwindling number of qualified contestants poultry exhibitions retain a following from a fairly strong section of the public who take pride in breeding poultry for nothing more than uniformity of type and colour and the prospect of gaining awards based on a standard of perfection.

RANDOM SAMPLE TESTS

The collection of a sample of eggs or day-old chickens at random from the breeders' flocks or incubators is a new system which replaced the testing of a few selected birds in the egg laying competitions. The stock are raised and managed under identical conditions, and the results from a sample of at least 40 pullets give a fairly accurate assessment of the qualities of the strain. It is therefore possible to measure the improvement or degeneration from selective breeding over a number of years. As breeding farms are much larger the breeder can work with greater numbers of birds for more rapid progress and avoid the deleterious effects of inbreeding.

The system first started in California in 1950. The value of random sample tests was quickly recognised by local breeders and hatcherymen and was introduced into the Hawkesbury College Laying Tests in 1952. Since 1955 all States of the Commonwealth have instituted official breeding schemes and random sample tests.

It is probable that later methods of farming will lead to still greater specialisation. There will probably be still fewer but larger breeding farms whose responsibility will be to supply foundation stock to those producing fertile eggs for hatcheries. Carefully planned tests will be studied by the egg producer and the size of each sample will have to be large enough to give confidence in the reliability of these tests. There will be more birds in future tests but fewer contestants compared with the 280 breeders who sought to enter six birds in the early competitions at Hawkesbury Agricultural College.

Methods being followed in Australia are very similar to those operating in the United States. Applied breeding has

materially stepped up individual egg averages. There is ample evidence that Australia already possesses strains capable of high production but they lack the same uniformity of genotype. There is at present a healthy competitive drive to improve the class of chicken available and the random sample tests will provide the clues to the degree of success accomplished by breeders who have to devote considerable time and expense to place poultry farming on a solid foundation.

THE POULTRY HUSBANDRY RESEARCH FOUNDATION IN THE UNIVERSITY OF SYDNEY

T. J. ROBINSON

Professor of Animal Husbandry
University of Sydney

The general field of Animal Husbandry, until quite recently, has been largely neglected in Australian Universities. There have been Schools of Agriculture and of Veterinary Science, but animal production, common ground to both, has been most inadequately covered.

This deficiency has been recognised and some steps, albeit inadequate, have been taken to rectify it. One such step was the establishment in 1955, within the University of Sydney, of a Department of Animal Husbandry, which Department services both the Faculties of Veterinary Science and Agriculture. This move was facilitated by a grant to the University of two adjacent farms now known as the University Animal Husbandry Farms, at Camden, some 40 miles from the main campus. This grant, together with that of sufficient funds to establish some student accommodation, lecturing facilities and a veterinary clinic, was made by three Commonwealth Government Boards representing the meat, wool and dairy industries.

The objective, since acquiring these Animal Husbandry Farms, has been to develop them to provide facilities for under-graduate and post-graduate training in all aspects of animal industry. In the past four years, such facilities have been provided for meat production, sheep husbandry, and dairying. Generous financial support was received from the respective industries; each of which is now levying itself to provide money for research and promotion. Continued financial support is therefore assured.

The situation in the poultry industry was more difficult. The industry in Australia is neither as large nor as well organised as the other primary industries nor as conscious of the value of research. Furthermore there has been no representation of the industry in Universities, and much of the extension work has been carried out by non-graduates. These remarks notwithstanding, there was a hard core of enlightened men who recognised the need for better trained personnel to serve the industry and these were formed into a Provisional Committee of a Poultry Husbandry Research Foundation. The objectives of this Provisional Committee and of the Foundation have been, and still are, to promote Poultry Science in the University of Sydney, with particular reference to the initiation of research projects of interest to the industry and the production of graduates highly trained in all aspects of poultry production.

The activities of the Provisional Committee culminated in the establishment of the Poultry Husbandry Research Foundation in the University of Sydney in May 1959. Present membership of the Foundation is composed of men representing farmer organisations, companies associated with the industry, e.g. feed manufacturers, drug companies and equipment manufacturers, banks, other organizations and individual producers.

The immediate objective of the Foundation was to provide finance to establish and run a Poultry Husbandry Research and Teaching Unit on the Animal Husbandry Farms. It was faced with three major problems, namely, finding (1) a scientist to take charge of it, (2) finance to build it and (3) finance to run it.

The first major problem was solved when in September 1959, Dr. H. W. McNary, formerly of the Department of Poultry Science, Purdue University, Indiana, U.S.A., took up appointment as first Director of Poultry Husbandry in the University of Sydney. Dr. McNary, who majored in poultry genetics, has had experience in other aspects of the poultry industry in the United States. He is at present making an intensive study of Australian conditions of poultry production so that the teaching of poultry husbandry, to be commenced in 1960, can be directly related to local conditions.

The second problem has been partly solved. Sufficient funds are in hand for a limited start to be made, and construction of the first part of the Poultry Unit is now in hand. It is expected that sufficient progress will have been made by

1962 for visitors to the World's Poultry Congress to see research and demonstration work being carried out.

The third problem, namely that of providing continued running costs, is the most serious. Modern research is expensive and pending official recognition of the Foundation and of its work accompanied by a subsidy, such as by an industry levy, it will be difficult for it to make full potential contribution to the industry. Nevertheless it is a most useful start and a clear demonstration of how a determined industry can help itself without official support.

Whilst the idea of a research foundation is not new in any country, to have one directly and solely concerned in the development of a particular primary industry is a new approach in Australia. In this instance the Foundation represents most sections of the poultry industry and has members from other States as well as the home State, New South Wales. All members have expert knowledge in their own fields. Consequently the Foundation has ready access, through its members, to information needed for any discussion or investigation of interest to the industry. This allows it to greatly assist industry in many directions.

A major function of the Foundation is the dissemination of knowledge. This is achieved by means of field days, seminars, conventions and summer schools, as well as by means of publication. Considerable progress has been made already in this connection. Last year there were held, at the University, a Poultry Science Convention in conjunction with the Australian Branch of the World Poultry Science Association. This Convention, which lasted four days, covered the fields of genetics, physiology and reproduction, poultry health, nutrition, husbandry, economics and marketing. Papers were presented by leading research and extension officers from Australian Universities, Government institutions, private industry and by some overseas experts. It is intended to make similar conventions a regular feature in the future, although at present all energies are being directed towards the World's Poultry Congress of 1962.

Students may now receive training in Poultry Husbandry in the University of Sydney, in one of several ways:—

1. All students of Veterinary Science receive some instruction in this subject in their final year of their course.

2. Students of Agricultural Science who specialise in Animal Husbandry, receive considerable training in the final

year of their course. Although no specialisation is permitted in any field of animal production, they may elect to do a small project in some aspect of Poultry Husbandry in that year.

3. A post-graduate Diploma in Poultry Husbandry in the Faculty of Agriculture has just been approved. This course, of one or two years duration depending on the academic background of the student, is designed to meet the needs of those students who wish to specialise in poultry husbandry extension work.

4. Post-graduate research training leading to either a Masters or Ph.D. degree, is available.

All these fields, quite new to Australian Universities, have been opened up by the activities of the Poultry Husbandry Research Foundation in the University of Sydney. It is a humble beginning but one which augers well for the industry in Australia, and indeed for the whole of South East Asia.

POULTRY DISEASES IN AUSTRALIA AND THEIR CONTROL

T. G. HUNGERFORD

Australia was first settled in 1788 and from then until 1900 the poultry industry gradually developed as a sideline to the Dairy Industry. Diseases occurred in individual fowls, but never assumed serious economic importance. From 1900 to 1960 the Commercial Poultry Industry gradually evolved, and with the intense development which has occurred in the last fifteen years, featuring very large plants (100,000 fowls and more) mass epidemics of disease sometimes occur, compelling the owner to use all available preventive and control measures.

Respiratory Diseases of Fowls: In this group of respiratory, catarrhal, or "roup" diseases, the most important are laryngo-tracheitis, chronic respiratory disease, mucoid-tracheitis and infectious catarrh, coryza, fowl pox and Vitamin A deficiency. Cholera and other infections may also produce respiratory symptoms.

Laryngo-Tracheitis: This occurs in all States of Australia where poultry farming is widely caried out, and from time to time causes very heavy economic losses. To illustrate in December, 1959 in one poultry farming district, we, as

veterinarians, were personally called in to six outbreaks of the disease during Christmas week, involving just under 40,000 fowls. On one farm in one yard of 2,000 birds, nearly 700 had died before the owner sought assistance. Mortalities may be devastating where nothing is done. Control is by vaccination. The usual age at which this is carried out will vary from 6 weeks to 18 weeks. The work is so timed that the disease will not spread from vaccinated groups to unvaccinated younger ones which are in contact with them. The vaccination is carried out in the cloaca and gives birds immunity for life. In broiler plants where laryngo-tracheitis can be very serious, control has been effected in recent years by vaccinating by the intrafollicular method. Virus is swabbed onto a plucked area of the thigh. This is done on chickens from day old, up to three weeks of age, and gives them immunity from nine to twelve weeks. This can be combined with the vaccination with pigeon pox or fowl pox. Both vaccines can be mixed, and swabbed on the same area.

Chronic Respiratory Disease, together with mucoid-tracheitis, infectious catarrh and coryza. These diseases comprise a clinical group which causes a very great amount of trouble. No doubt critical investigations will pinpoint all the causal organisms in the future, but, at the present it would appear likely that the pleuro-pneumonia-like organism, mycoplasma gallinarum, which causes chronic respiratory disease, acts in liaison with Haemophilus gallinarum (the cause of coryza), and at least two other distinct viruses. In these conditions there is no one clear-cut procedure, such as vaccination, which will effect control, but control must be effected by the combination of a number of measures which, taken together, are fairly effective. It is necessary to eliminate concurrent parasitic infestations with round or tape worms and to eliminate any deficiency of Vitamin A. In this connection it should be noted that feed which contains enough Vitamin A for normal purposes may only be eaten in unusually small amounts, by birds whose appetites are impaired by a respiratory disease, so that the feed should contain more than usual Vitamin A. The use of antibiotics has been of great value in some outbreaks of catarrhal diseases, thus Terramycin TM 5 (containing 5 grams of terramycin per pound) or aurofac feed supplement fed in either case so that at least 200 grams of the antibiotic per ton are included, has effected control. This should be fed continuously for at least ten days and then the amount

cut down gradually. In some outbreaks this does not give control. Many of such respond to injections of streptomycin, given at the rate of some 200 to 400 milligrams per bird, as an intramuscular injection in water. It has been shown that the bacterial flora of the respiratory tract in catarrhal diseases of poultry is frequently gram positive at first, and gradually the bacteria present are replaced by gram negative bacteria. It is at this stage that streptomycin injections are of real value. In many outbreaks of chronic respiratory disease and mucoid-tracheitis, the injection of streptomycin gives dramatic results. On the sixth day, in a yard where practically all birds were previously affected at the time of the injection, less than 5% may show any detectable symptoms. It would appear that the very large injection of streptomycin acts as a metabolic stimulant. It promotes egg laying, increases consumption of food and, as it were, "lifts" the bird out of its depressed chronic diseased state. In some outbreaks this highly desirable effect is followed by a relapse after about a fortnight or three weeks. It is, therefore, very important to carry out all supportive measures such as improved ventilation, and any other nursing measures which may be of value in assisting the recovery of the bird, which has been helped by the injection. To merely inject, and then to do nothing more is sometimes uneconomic.

Older measures of feeding sulphathiazole, sulphamezathine and sulphaquinoxaline particularly when supplied in the water still have their place but are of far less value than injections of streptomycin. The feeding of antibiotics, followed by the injection of streptomycin in resistant cases, has reduced the chronic respiratory disease complex from being a major limiting factor in the industry, to a disease group of much less importance. Five years ago many farmers were being put out of business due to the ravages of chronic respiratory disease, but in most cases these are now controllable by modern measures.

Fowl Pox: This virus disease is sometimes classed as a catarrhal disease, because, in addition to the warts, it does produce oculo-nasal symptoms. Worse still, during the systemic reaction to the disease, or to the vaccination to prevent it, if other catarrhal diseases are present the systemic reaction may trigger off a serious disease epidemic resulting in heavy loss. Control of fowl pox is effected by vaccination, which is

normally carried out at the age of twelve weeks. At any age from six to twelve weeks, the immunity set up as the result of vaccination with fully potent fowl pox virus, is lasting and effective. However, there is the question of multiple fowl pox virus strains which has received some attention in New South Wales, and at times there is a suspicion that vaccination with one strain may still leave the bird susceptible to another strain of fowl pox virus. In broiler plants and with autumn hatched chickens it is essential to vaccinate day old, or young chickens. This may be done with fully potent fowl pox virus (and there are many brands of this put up in industry and advertised as being special strains for day old vaccination). Alternatively, pigeon pox vaccination may be used. Pigeon pox does not cause systemic reaction, and there is no danger whatsoever in its use. However, the immunity established with pigeon pox is only partial, and while it does decrease the severity of subsequent outbreaks, it does not absolutely prevent them under severe conditions of challenge. Generally speaking vaccinating day old chickens for fowl pox is now considered more satisfactory since antibiotics such as terramycin TM 5 supplement, and aurofac feed supplement have become available. These should be fed from the tenth day following vaccination to the twentieth day, that is, during the period of systemic reaction to fowl pox. It is unusual to have trouble when these are fed.

Diseases of Chickens and Young Stock: Pullorum disease was once a great menace to the industry, but is now brought well under control by the rapid whole blood test. Where outbreaks do occur (rarely) feeding furazolidone at the rate of 0.04% in the mash will control outbreaks quite effectively. A false sense of security should not be induced by this drug because it still allows birds to remain carriers of the disease. Birds which have once suffered from an outbreak should never be bred from unless they are first subjected to a blood test, and all carriers removed.

Paratyphoid or Salmonella Infections: These are now becoming more common. They are the same type of organism which causes pullorum disease. Furazolidone is the drug of choice to effect control.

Chilling and Faulty Management Factors are always a source of death in many thousands of chickens and the control of this is of course a matter of correct brooder management.

Coccidiosis affects young birds, but has been brought

under effective control by the great flood of chemicals which have been introduced in recent years. Hygiene and cleanliness are always of importance in this disease. Caecal coccidiosis caused by *Eimeria tenella* is effectively prevented by drugs such as Nicrazin, Nefco and Toltro. When outbreaks do occur, they can be treated by sulphaquinoxaline or Toltro. Intestinal coccidiosis mainly caused by *Eimeria necatrix* remains a problem of the first magnitude. None of the modern drugs seem to be of any great value in treating and preventing the disease. In fact the older drugs such as sulphaguanadine, or alternating one week's treatment with 5% Flowers of Sulphur in the mash, and molasses six ounces to the gallon of drinking water used week and week about still seems to give as good control as any of the more modern treatments. When effective drugs are used for a week or ten days, such as sulphaquinoxaline or Toltro by way of treatment, the difficulty is that birds affected with intestinal coccidiosis do not develop an active immunity but, after treatment has ceased, further cases occur. It is common in pullets which are approaching laying age, to find perhaps that out of a thousand birds, six or seven are dead every morning and this may continue on for weeks.

Blackhead or Entero-Hepatitis is seen occasionally. It usually occurs during the systemic reaction to fowl pox. Control is effected by Furazolidone, Histosol or Entramin. Elimination of caecal worms with phenothiazine removes one predisposing cause.

Uraemia or Monocytosis: This has become the most important disease of the industry in the last six or seven years. It causes deaths in birds from those a few days old up to maturity. The dominant appearances are enlarged white kidneys, a whitish urate-filled diarrhoea, darkening of the muscles of the body, and death. It is of particular importance in that it has an unholy alliance with Laryngo-tracheitis. When birds which are suffering from incipient uraemia are vaccinated with Laryngo-tracheitis, it may stir up an active outbreak of the latter disease. The one clinical syndrome has apparently more than one cause. Thus some outbreaks act as infectious epidemics, spreading from group to group and yard to yard. Others seem to be predisposed by faulty feed conditions, and a large amount of research will be needed to elucidate the whole problem. At the present time effective control has not been devised. Some people feed from a quarter

to one per cent of muriate of potash in the food, others are depending on cutting down the protein supply and the amount of sodium chloride. In all circumstances the inclusion of half a cup (6 ounces) of molasses to the gallon of drinking water seems to be helpful. Feeding of Furazolidone and of Terramycin seems to have been of help in some outbreaks, but has failed in others. This is one disease that has caused the bankruptcy of some broiler growers and in this regard it must be considered easily the most important disease in the industry at present.

Omphalitis occurs from time to time in young chickens and is transmitted through the egg. At the present time there is no effective control although the feeding of furazolidone is of value in some outbreaks.

Haemorrhagic Disease and the haemorrhagic syndrome is a condition which has now become more common. It is associated with faulty metabolism of vitamin K and possibly associated with vitamin E. Cases have occurred following the excessive feeding of sulphaquinoxaline and other drugs which upset the metabolism of chickens. Control is by means of supplying excess vitamin K and vitamin E and attending to all possible causative factors.

Encephalomalacia occurs from time to time, sometimes after feeding of excess oil. Many cases are assisted by feeding excess vitamin E as in some instance the deficiency of vitamin E in the metabolism is the cause of the condition. Other outbreaks of the trouble are not so simply explained and are due to factors other than vitamin E.

Moniliasis is a disease which occurs occasionally in chickens and young stock. The yeast-like fungus produces lesions in the crop and gizzard. Control is by means of varying the diet, changing the reaction of the gut content, and possibly dilute solutions of bluestone.

Deficiency Diseases of chickens. *Rickets* is a disease which will occur when there is a deficiency of vitamin D and/or calcium and phosphorus and is noted from time to time particularly where chickens reared in battery brooders are on rations which are deficient in these constituents. *Perosis* is a disease which has a complex origin where there is deficiency of manganese or an excess of minerals which render the manganese unable to be assimilated. It may also be caused by deficiency of riboflavin, choline, nicotinic acid, vitamin B_{12}, and possibly other factors. *Worm infestations* may cause ser-

ious damage. Roundworms (Ascaridia galli) and tape worms (Raillietina spp) are perhaps the most common. Piperazine compounds and carbon tetrachloride are the drugs of choice for round worms and Dibutyl-tin-dilaurate or hexachlorophene are effective against tape worms, although the latter drug depresses egg laying. Staphylococcal infections cause serious trouble in broiler plants, particularly when associated with fowl pox. Control measures are not very satisfactory.

The *Leukosis group* of diseases cause trouble in Australia as in other countries.

Botulism occurs spasmodically and can be controlled by eliminating the source of infection and the source of the infected material.

Spirochaetosis occurs mainly in inland areas and can be prevented by vaccination, as well as by eradicating the vector (Argas persicus - the fowl tick).

Tuberculosis occurs in certain areas, and should be dealt with by slaughtering out or, alternatively, by extensive testing and slaughter.

Infectious synovitis is a minor problem in some broiler plants.

Fungal infections of the skin of the air sacs and lungs, assume importance occasionally and control is mainly by hygiene and dryness.

External Parasitic infestations crop up as a problem where management is lax and preparations of Gammexane, D.D.T., Kelthane, Dieldrin and Aldrin are of use.

MARKETING OF EGGS IN AUSTRALIA

R. C. BLAKE

Chairman, Australian Egg Board

Prior to 1928 the export of eggs in shell and frozen egg from Australia was negligible, but in that year the Marketing of Primary Products Act of New South Wales provided a means whereby farmers could set up their own marketing organization if a ballot of producers resulted in more than 50% in favour of such a course. The establishment of such Boards is by State legislation, as distinct from Australian wide or Commonwealth legislation. Thus, only producers in a State in which such legislation has been provided may take

advantage of it. However, Egg Marketing Boards were set up progressively in Queensland, New South Wales and Victoria where the necessary legislation was passed. This was followed some years later in South Australia, Western Australia and Tasmania.

The legislation in most of the States is closely similar. In most cases it provides that each three years the egg producers in the State may take a ballot and if the majority vote for the discontinuance of a Board, then that Board is wound up. It is worthy of note that despite the many vicissitudes through which the industry has passed in the last thirty years, there has never been an occasion when an Egg Marketing Board has been voted out by producers.

Perhaps the most apt description of the system adopted is that it is a system of compulsory co-operation. In the various States the methods and systems vary slightly in accordance with local conditions, but broadly speaking, eggs automatically become the property of the Board appointed to market the product on behalf of the industry, the producers having the right of payment for them according to grade and quality.

Membership of the several Boards varies from five to seven. In most instances a majority of the members are producers elected by the industry itself, the remaining one or two being appointed by the State Government to advise on commercial and financial matters. Each Board has one or more floors for the receipt of eggs from the producers within the State and is responsible for the candling and grading, packing, distribution and the selling. Prices are determined by the Board from time to time, and it is responsible for payment of net proceeds to producers.

It is not practicable for the Board to insist upon all eggs being delivered to the Board's own packing stations, for in some cases this would mean a duplication of transport and other costs. To overcome this difficulty, a system of "producer agencies" has been evolved. This means that certain producers are given a permit to sell the eggs produced on their own farms direct to retailers. The producers so licensed to sell must candle, grade and pack their eggs according to the standard specified by the Board, and must pay a levy or charge per dozen eggs sold as their share of the Board's cost of operating and of maintaining prices as fixed from time to

time. Approximately 40% of eggs produced in Australia are marketed by these "producer agents".

The main objective of each Board is to return to the producers the actual realisation from the sale of the product less only the actual cost of marketing. In order to achieve this objective it is imperative to prevent too rapid fluctuation of prices; once a price is fixed it is usually kept at that level for a considerable time, despite variation in the volume of supply. An oversupply or surplus is regulated by removing it either by cold storage, or export, or by transferring eggs for breaking out for frozen egg, which is used locally and also exported.

It is justifiably claimed that in an area controlled by a State Board, all producers receive the same price for the same grade of egg sold on the same day regardless of whether the egg is sold immediately as egg in shell on the local market, cold stored for later consumption, exported to a lower priced market, or processed into "frozen egg". In other words, all producers receive an equalised price for each grade.

The system has much to recommend it. Firstly, the fact that each Board agrees to accept all eggs sent to it by producers, at prices common to all at the same time, eliminates the possibility of producers competing against each other and unnecessarily depressing prices on the local market; secondly, the Board, having complete information on current supply and demand, can export, cold store or process the actual surplus thus keeping the local market steady; and thirdly, the Board as the owner or controller of all handling plants in the State is able to buy in bulk all cases and packing material, frozen egg containers, cartons etc. and thus reduce costs.

The successful operation of the State Egg Marketing Boards has demonstrated to the egg industry in Australia the value of coordination and co-operation in egg marketing and the principle of orderly marketing has been extended to the marketing of Australian eggs and egg products overseas by the Australian Egg Board. This Board was established by the Commonwealth Government, with the function of organizing the marketing of Australia's surplus of eggs and egg products overseas. It does not interfere with the normal functions of the State Boards, but is responsible for the development of overseas markets.

The Act under which it is constituted provides that the Chairman shall be a representative of the Commonwealth; and

each of the State Marketing Boards is represented on the Australian Board. Surplus eggs and egg products in each State are transferred to the Australian Egg Board and it is then this Board's function to find overseas markets, ship to them on the best possible terms and pay proceeds to the State Board concerned. One of the major objectives of the Australian Board is to prevent the depressing of prices which would certainly occur if the State Boards were competing against each other for a limited overseas market.

THE IMMUNOGENETICS LETTER

The Immunogenetics Letter was formally established by the immunogenetics group at a meeting held in conjunction with the International Congress of Genetics in Montreal, Canada, August 23, 1958. Its purpose is to provide a medium for presentation of ideas, techniques and research reports of a preliminary nature in the field of immunogenetics.

Those working with immunogenetics in poultry will find this letter extremely informative. Inquiries regarding the Immunogenetics Letter should be addressed to:

Dr. Clyde Stormont
The Serology Laboratory
Department of Microbiology
School of Veterinary Medicine
University of California
Davis, Calif., U.S.A.

XIITH WORLD'S POULTRY CONGRESS—1962

SUBJECTS FOR SYMPOSIA

The Scientific Program Committee of the 12th World's Poultry Congress is giving consideration to suitable subjects for symposia to form part of the Congress program at Sydney, Australia, August 10-18, 1962. The Committee will welcome suggestions regarding subject matter for symposia. Communications should be addressed to Dr. F. Skaller, Chairman, Scientific Program Committee, 12th World's Poultry Congress, P. O. Box No. 1, Castle Hill, New South Wales, Australia, and should reach him not later than December 31, 1960.

RULES FOR ACCEPTANCE OF PAPERS

The Congress Organization desires to announce the "Rules for the Acceptance of Papers", which are as follows:

1. The headings of the sections at the Paper Reading Sessions will follow those adopted at previous Congresses as follows:
   (a) Genetics and Breeding.
   (b) Nutrition and Physiology.
   (c) Diseases and their Control.
   (d) Economics and Marketing.
   (e) Husbandry.
2. Where National Committees have been set up they will receive papers and decide whether to accept them for submission to the Congress Organisation. Authors from countries which do not have a National Committee should submit their applications to present a paper together with copies of the paper direct to the Secretary General.
3. It will be open for any person to submit a paper for presentation at the Congress whether or not a member of the World's Poultry Science Association and whether or not the country is officially represented at the Congress.
4. Any person submitting a paper should indicate whether or not he will attend the Congress in person to present it. In accepting papers, priority of acceptance will be given to those to be presented personally by the authors unless the paper is of unusual quality and outstanding in facts or findings.
5. As papers will be available prior to the Congress, the author if present will be allowed to give only a review of his paper and to speak to it over a limited period of time to be advised later.
6. In the exceptional case where an author is not able to present his paper only some one closely associated with his work from the same reseach centre, institute or firm, and nominated by the author will be allowed to speak to it. In no case will some one not familiar with the work be allowed to do so.
7. The method of presentation of papers should follow the "C.S.I.R.O. Guide to Authors" available from the Secretary General. A paper should not exceed 2,500 words or be less than 1,250 words. It should be typewritten in triplicate in either of the official languages, English or French, and be accompanied by a summary not exceeding 300 words in *both* the official languages.
8. Drawings, graphs or charts may accompany papers but the number should be kept within reasonable limits. Any person wishing to show a film or slides illustrating his paper or on some subject likely

to be of interest to the Congress should intimate the title, size and approximate length of the film or number of slides.

9. A title and synopsis of the paper proposed to be submitted should be sent to the Secretary General before 1st August, 1961, and the complete papers must be in the hands of the Secretary General by 31st October, 1961. The address is:

   The Secretary General
   XIIth World's Poultry Congress
   Department of Primary Industry
   Canberra, A.C.T.
   Australia

10. The number of papers to be accepted will be restricted to about 100. The Congress Organisation reserves the right to edit as it thinks proper all papers selected for presentation.

11. The Secretary General will supply reprints of a paper, at the author's cost, if they are ordered at the time the paper is submitted.

PLANS FOR TRADE EXHIBITION

MR. J. E. BEVERIDGE, Chairman of the Executive Committee of the 1961 Sydney Trade Fair, will be leaving Sydney on July 31 on an extensive overseas tour to interview principals of 20 countries regarding participation in the Fair, including the U.S.S.R.

Mr. Beveridge will also be an official honoured guest at the Leipzig, Berlin, Strasbourg, Milan and Marseilles Trade Fairs. By invitation of the Commonwealth Government, he will be attending Guest Nation Day at the Swiss National Fair in Lausanne when the Australian Pavilion will be officially handed over to the Comptoire Suisse, and will later attend the Australian Business Seminar in Lausanne as one of the Australian businessmen who will answer questions about trade possibilities, particularly in relation to Exhibitions.

Mr. Beveridge is the Managing Director of Industrial Public Relations Service (N.S.W.) Pty. Ltd. who have been commissioned by the Commonwealth Congress Committee to organise the trade exhibition to be held in conjunction with the XIITH WORLD'S POULTRY CONGRESS, and whilst overseas will extend invitations to countries to participate in the exhibition to be held at the Royal Agricultural Society's Showgrounds, Sydney, in 1962.

He will be carrying messages from the President of the Sydney Trade Fair, the Premier of N.S.W. and the Chairman of the Citizen's General Committee, the Lord Mayor of Sydney. In his tour he will travel 37,000 air miles visiting more than 22 countries, and will be accompanied by his wife and daughter.

REVIEW OF POULTRY PUBLICATIONS

(*Abstracts from Animal Breeding Abstracts* and from *Nutrition Abstracts and Reviews* are reproduced by arrangement with the Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England.

Acknowledgment is also made to Biological Abstracts, University of Pennsylvania, Philadelphia 4, Pennsylvania, U.S.A. for the Abstracts taken from *Biological Abstracts*.)

NUTRITION

BROWN, W. O.

A PELLETED PROTEIN CONCENTRATE IN A DIET OF WHOLE GRAINS FOR EGG PRODUCTION. *Res. Exp. Rec. Minist. Agric N. Ireland*, 1957, 7, 114-121.—Laying pullets in 3 groups, in pens with access to pasture, were fed on 9 parts by weight of whole oats to 1 part of pellets. The pellets supplied minerals; minerals plus vitamin A, D and B components; or minerals, vitamins and 5 per cent. fishmeal for the respective groups, and had 6.8, 6.9 and 36.9 per cent. crude protein. A fourth group got a high quality mash with 19 per cent. crude protein to appetite and 1½ oz. oats per head daily. The pellets were not well accepted. When vitamins were withheld egg production declined, and over the whole period of 96 days production was unsatisfactory in all groups except that getting the high quality mash.

The second trial was similar to the first, but all the pellets had 50 per cent. fishmeal, and about 38 per cent. crude protein; one had minerals only, one had minerals and vitamins and one had minerals, vitamins and penicillin. A fourth group again got mash and limited grain. There was little difference among groups in egg production. feed required per doz. eggs or bodyweight gain. Similar results were obtained in 2 further trials in which similar pellets were used but the grain was a mixture of oats, wheat and kibbled maize. The use of high-protein pellets and a high proportion of whole grains is suggested as practicable, and there seems to be no advantage in adding vitamins or antibiotics when the birds have access to pasture.—T. D. Bell. (Nutrition Abstracts & Reviews)

CACIOPPO, F., S. MACAIONE, and **R. BUZZANCA.** Influenza dell'avitaminosi B_1 sulla ossidazione del succinato.

EFFECT OF VITAMIN B_1 DEFICIENCY ON THE OXIDATION OF SUCCINATE. *Boll. Soc. ital. Biol. sper.*, 1959, 35, 467-469. [Ist. Chim. Biol., Univ. Palermo.]—Of 3 groups each of 4 pigeons the first were forcibly fed on 30 g. polished rice per head daily; the second group were given 1 mg. vitamin B_1 daily by injection and were fed on polished rice in amounts restricted to produce about the same loss of weight as in the first group; the third group were fed freely on maize and wheat. As signs of vitamin B_1 deficiency became clear in the first group each bird was killed with one from each of the other groups and homogenates of heart tissue were prepared. Oxygen consumption of the homogenates, without substrate added or with sodium succinate, was measured for 90 min.

Oxygen consumption per mg. dry tissue, with or without succinate, was significantly less in the deprived animals than in those not deprived of vitamin B_1. Oxidation of succinate was not depressed, but slightly increased, in the underfed, compared with the normally fed birds so it is concluded that the effects in the deprived birds could not be attributed to underfeeding.—D. Duncan. (Nutrition Abstracts & Reviews)

DINNING, J. S., and R. S. YOUNG.
THE ROLE OF VITAMIN B_{12} IN THYMINE BIOSYNTHESIS BY CHICK BONE MARROW. *J. Biol. Chem.*, 1959, 234, 1199-1201. [Dept. Biochem., Univ. Arkansas Sch. Med., Little Rock.]—When deoxyuridine and formate-^{14}C were incubated with suspensions of bone marrow from chicks deprived of folic acid and vitamin B_{12} the synthesis of thymine labelled in the methyl group was half that when the chicks had received vitamin B_{12} by intramuscular injection. Folic acid in the diet increased synthesis, but not significantly. Vitamin B_{12} increased synthesis when added *in vitro* but did not affect synthesis of protein from glycine-1-^{14}C or leucine-1-^{14}C. Glutathione had no effect.—A. Hepburn. (Nutrition Abstracts & Reviews)

EDMONDSON, J.
VITAMIN REQUIREMENTS OF POULTRY AND DEFICIENCY DISORDERS. *N. Z. J. Agric.*, 1959, 98, 29: 31-32. [Dept. Agric., Upper Hutt] (Nutrition Abstracts & Reviews)

EDMONDSON, J.
IMPORTANCE OF MINERALS FOR POULTRY. *N. Z. J. Agric.*, 1959, 98, 137-139. [Dept. Agric., Upper Hutt, Wellington.] (Nutrition Abstracts & Reviews)

ELLIS, T. H., and R. M. HOVEY.
A GRAPHIC METHOD FOR PRESENTING A MARGINAL ANALYSIS USING FEED SUBSTITUTION AND PRODUCTION FUNCTIONS. *J. Farm Econ.*, 1958, 40, 941-947. [N. Dakota Agric. Coll., Fargo.]—Data from 46 flocks of turkeys are used to find the relation between growth and consumption of grain and mash. The relative amounts of grain and mash consumed for average growth, and the substitution rate of one for the other, are determined. Tabular and graphical methods to find the most economic combination of the 2 ingredients if the mash : grain price ratio is known are presented.

A similar procedure is followed to illustrate a method of finding the most economic weight at which to sell turkeys, given the market cost of feed and of turkeys.—A. W. Boyne. (Nutrition Abstracts & Reviews)

EVANS, R. J., S. L. BANDEMER, J. A. DAVIDSON, and D. H. BAUER.
PROTEIN DISTRIBUTION IN FRESH AND STORED SHELL EGGS FROM HENS FED CRUDE COTTONSEED OIL. *J. Agric. Food Chem.*, 1959, 7, 47-50. [Dept. Agric. Chem., Michigan State Univ. Agric. Appl. Sci., East Lansing.]—Of 64 eggs from 11 pullets given a diet containing 2.5 per cent. cottonseed oil only 20 had the typical pink discolouration. Electrophoretic studies showed that when the eggs were stored for 6 months at 0° C. there was a transfer of egg-white proteins, except ovomucoid and ovoglobulin, from white to yolk, and of livetin from yolk to white. Lipovitellin was also partly converted to another electrophoretically similar protein. For previous work see Abst. 4852, Vol. 28.—A. Hepburn. (Nutrition Abstracts & Reviews)

EYLES, D. E., and S. J. COWLISHAW.
SIMPLIFIED RATIONS FOR POULTRY AT PASTURE. *Empire J. Exp. Agric.*, 1959, 27, 158-169. [Grassland Res. Inst., Hurley, Berks.]—Grain alone was inadequate to maintain bodyweight and egg production even when pasture was available. Addition of 10 per cent. fishmeal to a ration of cereals and minerals significantly improved egg production and egg size during the first laying year in birds on pasture. A mash and grain diet mainly of wheat and minerals was adequate for maintenance of bodyweight in pullets on restricted grazing, but they came into lay 2 weeks later and laid fewer eggs than pullets receiving a normal mash and grain diet. When cod liver oil was omitted from the ration of laying hens housed on wood floors egg production during the first and second laying years was lower than that of birds on the same ration folded on pasture.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

FANGAUF, R., H. VOGT, and G. v. BARLOWEN. Die Bedeutung des Roggens als Huhnerfutter.

IMPORTANCE OF RYE AS A POULTRY FEED. *Arch. Geflugelk.*, 1959, 23, 73-87. [Lehr- Versuchsanst. Kleintierzucht, Kiel-Steenbek.] English summary.—Rye, 10, 14 or 20 per cent. of the ration, replacing some wheat, barley and wheat bran in the basal ration of chickens from day-old to 8 weeks did not significantly affect weight gain or efficiency. With 30 per cent. rye mortality was righer and feces were wetter, but otherwise the health and general condition of all chickens were good. It is concluded that 20 per cent, rye can be profitably included in poultry rations.—R. G. Hankin. (Nutrition Abstracts & Reviews)

FANGAUF, R., H. VOGT, and G. V. BARLOWEN. Nebenerzeugnisse der Maisstarkefabrikation im Kukenfutter.

BY-PRODUCTS OF THE MANUFACTURE OF MAIZE STARCH AS CHICK FEED. *Arch. Geflugelk.*, 1959, 23, 192-202. [Lehranst. Kleintierzucht, Kiel-Steenbek.] English summary.—Day-old New Hampshire chicks, 452, were given for 8 weeks an all-mash diet containing maize gluten or a maize gluten feed, or both, or neither. Both maize products increased the amount of methionine, cystine, threonine and histidine and reduced the amount of arginine, glycine, lysine and tryptophan in the diet. Maize gluten could replace up to 66.7 and maize gluten feed up to 53.3 per cent. of soya bean meal protein in the rations without ill effect if the resulting energy deficit was made up. It was recommended that attention should be paid to the amino acid balance and to the amount of productive energy in rations containing more than 5 per cent. maize gluten or 10 per cent. maize gluten feed.—I. R. Anderson. (Nutrition Abstracts & Reviews)

FELTWELL, R.

FEEDING BROILER CHICKS. *Fertiliser and Feeding Stuffs J.*, 1959, 50, 369; 371.—Rations for broilers should be formulated to ensure maximum feed intake and most rapid growth rate. A ration expensive in terms of cost per ton may well give highest returns in profit per batch of birds. Points to be emphasised are that a coccidiostat and grit should be added to the ration and that the feed, particularly maize, should be freshly ground and of low fibre content.—M. E. Falconer. (Nutrition Abstracts & Reviews)

FERGUSON, T. M., R. L. ATKINSON, G. L. FELDMAN, C. H. WHITESIDE, J. H. QUISENBERRY and J. R. COUCH.

THE EFFECT OF UNIDENTIFIED FACTOR SOURCES, ANTIBIOTICS AND D-α TOCOPHERYL ACETATE ON THE REPRODUCTIVE PERFORMANCE OF BROAD BREASTED BRONZE AND BELTSVILLE SMALL WHITE TURKEYS. *Texas Agric. Exp. Stat. Bull.* No. 914, August 1958, pp. 15.—Studies on the nutrition of the breeding turkey hen since 1950 are reviewed. Addition to an all-vegetable ration of 3 to 5 per cent. fishmeal, distiller's dried solubles, condensed fish solubles, alfalfa meal, dried brewer's yeast or a liver preparation increased the hatchabilitv of fertile eggs. A combination of 2 or 3 of these sources of unidentfied substances was most effective in producing, and maintaining for 17 to 24 weeks, a high hatching capacity. On unsupplemented diets hatchability decreased greatly 8 to 12 weeks after laying began. Sources of unidentified substances which influence hatchability or anti-oxidants did not affect the tocopherol content of the yolk, but adding D-α-tocopherol raised it from 200 to 838 μg. after it had been given for 9 weeks. Inclusion of vitamin E in an all-vegetable ration, supplemented or not wtih sources of unidentified substances, increased hatchability. Eye lesions and high mortality occurred in embryos of eggs from hens on all-vegetable rations, but supplements of vitamin E prevented the lesions and reduced mortality.

Egg production was increased by adding dried brewer's yeast combined with fish solubles to the ration. The average amount of feed required to produce an egg ranged from 1.12 to 1.66 lb.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

FERRANDO, R., and J. KOENIG. Les matieres grasses dans les rations de croissance destinees aux poulets.

FAT IN RATIONS FOR GROWING CHICKENS. *Rec. Med. vet.*, 1959, 135, 5-12. [Lab. Aliment., Ecole Nat. Vet., Alfort.] English and Spanish summaries.—Groups of 24 chickens were reared in batteries on one of 11 diets composed of mixtures of common feedingstuffs with or without 4 or 6 per cent. beef fat or palm oil. Protein content of the rations ranged from 18 to 24 per cent. Mean growth after 9 weeks was 5 per cent greater with fat in the diet than without when the protein content of the diet was high, and it was considered that protein should not be less than 21 per cent., growth with less being poor. A second experiment confirmed the first, during which there was disease. The advantage of adding fat outweighed the increased cost to an extent that seemed to make the addition economically worth while.—E. M. Hume. (Nutrition Abstracts & Reviews)

FORBES, M., and J. T. PARK.

GROWTH OF GERM-FREE AND CONVENTIONAL CHICKS: EFFECT OF DIET, DIETARY PENICILLIN AND BACTERIAL ENVIRONMENT. *J. Nutrition*, 1959, 67, 69-84. [Germ-Free Animal Res. Unit, Walter Reed Army Inst. Res., Washington, D.C.]—A total of 350 germ-free White Leghorn chickens were reared in one of 4 environments: germ-free or non-sterile units, in a room not previously occupied, or in the same room infected with intestinal contents from chickens that responded to penicillin.

Sterile diets based on casein and starch or on soya bean were used. Penicillin was given as the potassium salt, 25 mg., or the procaine salt, 45 mg. per kg. feed. It was mixed with starch and sterilised by radiation. On all diets germ-free chickens gained 14 to 25 per cent. more than those with micro-organisms. Penicillin did not affect growth of germ-free chickens or those reared in the hitherto unused room. When chickens were infected with a flora from others which regularly responded to penicillin, the antibiotic in the diet inhibited the depressing effect of the micro-organisms and raised the growth rate, but not to that of the germ-free chickens. The results support the hypothesis that penicillin increases growth rate by inhibiting micro-organisms.—J. G. Gordon. (Nutrition Abstracts & Reviews)

FOX, M. R. S., and G. M. BRIGGS.

EFFECTS OF DIETARY LACTOSE UPON CHICKS FED A PURIFIED DIET. *Poultry Sci.*, 1959, 38, 964-968. [Lab. Nutrit. Endocrinol., Nat. Inst. Arthritis Metabol. Dis., Pub. Health Serv., Bethesda, Md.]—In 16 experiments in which chicks were reared to 4 weeks on a purified ration the inclusion of 20 per cent. lactose significantly improved growth rate. With a practical ration lactose had no effect. With each ration feed efficiency was reduced by lactose. Birds given lactose were normal, but intake of water was from 25 to 100 per cent. higher than without lactose, and the faeces had a higher moisture content. When lactose was added to the purified diet at from 5 to 30 per cent. growth was improved; 40 per cent. had no effect and 60 per cent. depressed growth. Adding 10 per cent. galactose to the purified ration had no detrimental effect on growth, and no sign of poisoning was found. Reduction of the glucose in the ration from 61.5 to 41.5 per cent. increased the rate of growth to that obtained by adding 20 per cent. lactose. Adding 20 per cent. indigestible matter to the purified ration also stimulated growth, but less than did lactose. Preliminary experiments on lactose excretion showed that only about half the lactose was absorbed.—J. S. Thomson. (Nutrition Abstracts & Reviews)

GANGULY, J., S. KRISHNAMURTHY, and S. MAHADEVAN. THE TRANSPORT OF CAROTENOIDS, VITAMIN A AND CHOLESTEROL ACROSS THE INTESTINES OF RATS AND CHICKENS. *Biochem. J.*, 1959, 71, 756-762. [Dept. Biochem., Indian Inst. Sci., Bangalore.]—Chickens on a diet low in carotenoids, and adult male rats, were starved for 24 hr., given an oily solution of α-tocopherol with vitamin A or cholesterol or one of their esters, or β-carotene, lycopene or lutein, and killed when the dose had reached the small intestine, in from 60 to 90 min. for the rats and from 150 to 180 min. for the chickens. The intestines were removed and the mucosa was separated from the muscle. Each tissue was homogenised and separated into nuclear, mitochondrial, microsomal and supernatant fractions, in each of which the substance given was estimated.

Vitamin A, given as the ester or the alcohol, was present in both forms in both tissues of both species. The supernatant fraction contained about two-thirds of the ester, but the alcohol was more diffusely distributed.

Whatever the form of cholesterol given, it was always present almost wholly in the free form, and mostly in the microsomal fraction of both tissues in both species. In the mucosa the concentration was about 2-5 mg. per g. in chickens and about 1-6 mg. per g. in rats; it was not altered by giving cholesterol. That in the muscles was similar and increased only a little when cholesterol was given.

No carotenoid was found as more than a trace in these intestinal tissues except lutein, which in chickens was present in high concentration in muscle and mucosa, mostly in the mitochondrial and microsomal fractions, and in rats in low concentration, mostly in the supernatant fraction of the mucosa.—J. Quarterman. (Nutrition Abstracts & Reviews)

GASSMANN, B., and H. PLESSING. Uber die chemische Bestimmung von Riboflavin in Lebensmitteln. 2. Das Analysenverfahren.

THE CHEMICAL ESTIMATION OF RIBOFLAVIN IN FOODSTUFFS. 2. THE METHOD OF ANALYSIS. *Ztschr. Lebensmittel-Untersuch.-Forsch.*, 1959, 109, 135-145. [Inst. Ernahrung, Potsdam-Rehbrucke.] For part 1 see *Nahrung*, 1958, 2, 450.—2. The proposed method involves autoclaving the sample containing 15 to 100 μg. riboflavin with 0.1 *N* HCl at 121° C. for 30 min., adjusting the *p*H of the mixture to between 4.5 and 5.4 and digesting with diastase. Portions of the filtrate from the digest are extracted with chloroform and samples of the aqueous phase are treated with permanganate. The resulting solution is made alkaline, exposed to light, acidified with acetic acid and oxidised again with permanganate. The lumiflavin present is extracted into chloroform and estimated fluorimetrically.—H. G. Bray. (Nutrition Abstracts & Reviews)

GAZO, M., L. LANDAU, and K. MARCINKA. Bilancia vapniku a fosforu u nosnic v podmienkach hypokalcemickej vyzivy.

CALCIUM AND PHOSPHORUS METABOLISM IN LAYING HENS ON LOW-CALCIUM DIET. *Pol'nohospodarstvo*, 1959, 6, 583-598. [Lab. Physiol. Farm Animals, SAV, Ivanka pri Dunaji, Czechoslovakia.] English and Russian summaries.—For 31 days 12 White Leghorn hens were given a ration with only 0.038 to 0.071 per cent. Ca. In other respects their rations were balanced and had adequate vitamins. A group of 6 hens were given the same ration supplemented with ground eggshells. Ca content of the shells of eggs laid by the birds getting low Ca decreased gradually and the fourth and fifth eggs had soft shells. For these birds the intervals between laying were increased. When the diet low in Ca was started, Ca in the droppings immediately decreased, but it increased slowly when Ca was added to the ration and a normal value was reached after 8 to 10 days. Normal Ca in eggshells was found 2 or 3 days after the diet low in Ca was discontinued. During the period of Ca deficiency the P in the droppings increased. After 31 days of Ca deficiency the hens were in negative Ca balance.—A. Jancarik (Czechoslovakia). (Nutrition Abstracts & Reviews)

GEBAUER, H., Eine neue Wirkung des Vitamins B_{12}. Verlangerung der Lebensdauer von Erythrozyten bei Huhnern.
A NEW EFFECT OF VITAMIN B_{12}. PROLONGATION OF THE LIFE SPAN OF ERYTHROCYTES IN FOWLS. *Vitamine u. Hormone*, 1954, 6, 185-193. [received April 1959]. [Anst. Vitaminforsch., Potsdam-Rehbrucke.] (Nutrition Abstracts & Reviews)

GOBEL, G. Der Einfluss einer Futterbeigabe von Methionin auf das Junghennenwachstum.
EFFECT OF A METHIONINE FEED SUPPLEMENT ON THE GROWTH OF YOUNG HENS. *Jahrb. Arbeitsgemeinschaft Futterungsberatung*, 1957/58, 1, 214-220.—Pullets were given a basal ration containing 0.342 per cent. methionine. Supplements of 0.15 per cent. methionine or of methionine and 1 mg. penicillin per cent. improved feed utilisation for growth by 5 per cent.—R. G. Hankin. (Nutrition Abstracts & Reviews)

GOBEL, G. Eiweissrationen fur die Legehennenfutterung.
PROTEIN RATIONS FOR LAYING HENS. *Jahrb. Arbeitsgemeinschaft Futterungsberatung*, 1957/58, 1, 232-248.—In 2 series of trials a protein mixture of fishmeal 33, field beans 41 and soya bean meal 26 per cent. was compared with one of field beans 62 and soya bean meal 38 per cent. When the 2 mixtures supplied 15 g. digestible protein daily there was no difference in egg production or feed efficiency. When the mixtures supplied 12 g. digestible protein daily the hens given the mixture containing fishmeal laid 7 per cent. more eggs and feed efficiency was 13 per cent. better.—R. G. Hankin. (Nutrition Abstracts & Reviews)

GRIMINGER, P., and H. FISHER.
DIETARY SAPONIN AND PLASMA CHOLESTEROL IN THE CHICKEN. *Proc. Soc. Exp. Biol. Med.*, 1958, 99, 424-426. [Dept. Poultry Sci., Rutgers Univ., New Brunswick, N. J.]—In the first and second experiments chicks received a low-protein diet from the age of 1 day and 1 week, respectively, and plasma cholesterol was estimated after 24 or after 16 and 23 days on the diet, which, consisted mainly of cerelose and starch, with 12 per cent. Assay protein C-1. The third experiment was on cockerels 1 year old, given a ration with 6.25 per cent. soya bean meal, containing 50 per cent. protein, as source of protein. Plasma cholesterol was estimated after 10 and 20 days. In each experiment the basal diet was given alone, or with 0.3 per cent. cholesterol or 0.6 per cent. saponin, or both, or extra protein.

Plasma cholesterol was considerably higher on the low-protein diets in all 3 experiments than when protein was added to give normal levels. The rise was somewhat less when saponin was given. Cholesterol increased the rise, but not quite so much as saponin; the values with cholesterol and saponin were higher than on the low-protein diet alone. Saponin reduced the weight gains of the chicks, an effect not prevented by cholesterol, and the cockerels given saponin lost weight more rapidly than those on the low-protein diet alone or with cholesterol; saponin reduced feed intake.—D. Duncan. (Nutrition Abstracts & Reviews)

GRIMINGER, P., and H. M. SCOTT.
GROWTH RATE AND LYSINE REQUIREMENT OF THE CHICK. *J. Nutrition*, 1959, 68, 429-442. [Dept. Poultry Sci., Rutgers Univ., New Brunswick, N.J.]—Variations in growth rate of chickens were obtained by selecting from one population for fast and slow growth; giving saponin to depress growth, selecting fast and slow growing birds from 2 different breeds; and inoculating chicks with the virus of bronchitis. For 14 days the chickens were given basal diets low in lysine, 0.53 per cent., supplemented with lysine at graded levels. Differences in growth rate, either in chickens from one population or

from 2 different breeds, did not influence the lysine requirement for optimum growth, about 1 per cent. Saponin reduced gains and growth rate to two-thirds of the normal, but did not alter the level of lysine at which optimum growth was obtained.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

HARKIN, A. M., C. KITZMILLER, G. L. GILPIN, and **S. J. MARSDEN.** QUALITY OF THE COOKED MEAT OF TURKEYS FED ANIMAL OR VEGETABLE PROTEIN DIETS WITH VITAMIN AND FAT SUPPLEMENTS. *Poultry Sci.*, 1958, 37, 1328-1339. [Human Nutr.-it. Res. Div., Inst. Home Econ., U.S. Dept. Agric., Beltsville, Md.]—Groups of turkeys 16 weeks old were fed on vegetable protein rations supplemented with vitamin A and D oil and 4 per cent. lard, or with dry vitamin A and 4 or 8 per cent. lard. Other groups had rations containing animal protein supplemented with vitamin A and D oil, alone or with 4 per cent. lard, or with dry vitamin A alone or with 4 per cent. lard. Sample carcases were roasted at 325° F. or braised at 450° F., and flavour, incidence of off-flavour, and tenderness and juiciness were assessed by taste panels and mechanically.

On vegetable protein 8 per cent. lard gave better finish than the other rations. On this ration flavour of thigh muscle was better than on any other ration. No difference was noted in flavour of breast meat. Off-flavour, and in particular the incidence of fishy flavour, was highest in thigh muscle and skin of turkeys on the animal-protein ration containing vitamin A and D oil. Tenderness and juiciness of meat were not affected by the ration, and there was no difference between methods of cooking except that the appearance of the birds was better when they were roasted.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HARNISCH, S., and **M. BECKER.** 3. Vergleich der aus der Bilanz errechneten N-Retention mit dem N-Ansatz bei jungen wachsenden Kuken (Hahnchen) und Schweinen.

COMPARISON OF THE N RETENTION CALCULATED FROM THE BALANCE WITH THE N INCREMENT IN YOUNG GROWING CHICKENS (COCKERELS) AND PIGS. *Arch. Tierernahrung*, 1958, 8, 401-419; 420-432. [Inst. Tierphysiol., Univ. Kiel.]—In two similar trials with groups of 6 growing chicks the mean differences between N retention estimatel from balance trials and obtained by carcase analysis were 2.2 ± 4.5 and 1.6 ± 3.6 per cent. In two trials with groups of 3 pigs initially 3 weeks old the differences were 0.3 and 0.5 per cent. of retention in the course of 20 to 25 days. The error was again so variable that no single source could be ascribed to it, in contrast to the regular error producing cumulative N balances larger than the amount of N deposited, which has been obtained by other workers.—D. Duncan. (Nutrition Abstracts & Reviews)

HARTSOOK, E. W., R. V. BOUCHER, and **T. V. HERSHBERGER.** THE EFFECT OF DIETARY ANTIBIOTICS UPON HEPATIC AND RENAL XANTHINE DEHYDROGENASE ACTIVITY IN CHICKS. *Arch. Biochem. Biophys.*, 1959, 82, 310-318. [Dept. Animal Nutrit., Pennsylvania State Univ., University Park.]—White Leghorn cockerels were given, in two experiments, an adequate practical diet supplemented, per ton, with 15 g. oxytetracycline or 6 g. procaine penicillin. Fresh liver and kidney homogenates from chicks 4 and 9 weeks old were tested *in vitro* for xanthine dehydrogenase activity.

Oxytetracycline significantly inhibited the activity per g. dry kidney of chicks at 4 weeks but not at 9 weeks of age. The inhibition by penicillin was not significant. Liver xanthine dehydrogenase was not affected by either antibiotic in any of the chicks. The inhibition of kidney enzyme occurred during the period at which antibiotics exert the greatest stimulating effect on growth, and it is considered that the inhibition may cause N to remain longer in the metabolic pool, thus increasing the possibility of its being used for synthesis of nitrogenous tissue components.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

HEYWANG, B. W.

THE EFFECT OF ARSANILIC ACID AND LOW LEVELS OF ANTIBIOTICS ON LAYING CHICKENS DURING HOT WEATHER. *Poultry Sci.*, 1959, 38, 854-858. [Agric. Res. Serv., U.S. Dept. Agric., Animal Husb. Res. Div., Glendale, Ariz.]—Egg production and other data are reported for 3 experiments made in successive years with groups of White Leghorn pullets fed during both the cooler and the hotter seasons of the year on an all-mash practical ration alone or supplemented with 90 g. arsanilic acid, 10 or 50 g. chlortetracycline, 4 g. procaine penicillin or a mixture of 5 g. chlortetracycline and 2 g. procaine penicillin per ton. During the cooler season average maximum temperature was from 71° to 76° F. and during the hotter season from 97° to 102°.

During the cooler season average data from the 3 experiments showed that all the supplements increased egg production, but the increases were not significant. During the hot weather all supplements except the combination of chlortetracycline and penicillin increased egg production significantly. Feed consumption during the 2 seasons was not affected by the supplements, but efficiency of egg production was much improved by all. Neither egg weight nor hatchability of fertile eggs was affected, nor was mortality in the pullets, which was much higher during the hot than during the cooler season. Weight gain during the cooler season and weight loss during the hot season were not affected. Results obtained by adding 100 g. chlortetracycline per ton were similar to those obtained with 50 g.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HEYWANG, B. W., C. R. THOMPSON, and **A. R. KEMMERER.**

EFFECT OF ALFALFA SAPONIN ON LAYING CHICKKENS. *Poultry Sci.*, 1959, 38, 968-971. [Southwest Poultry Exp. Stat., Glendale, Ariz.]—Two experiments are reported with laying pullets, in each of which saponin extracted from alfalfa was added to a practical control ration at a level of 0.4 per cent., or 20 per cent. sun-cured alfalfa meal was added to supply 0.26 per cent. saponin. Pre-experimental egg production, on a ration without saponin, was similar for comparable groups.

Egg production in the 2 experiments during 50 days in the groups receiving extracted saponin was only 51 and 43 per cent. that of control groups, and feed consumption was 29 and 38 per cent. less. When saponin was supplied as alfalfa meal egg production was 73 and 66 per cent. of that of controls and feed consumption 2 and 7 per cent. less. Saponin had no effect on egg weight or weight of the pullets. Egg production in the saponin groups returned to normal soon after the saponin was removed from the ration. The level of alfalfa meal was higher than that normally given, and it is suggested that the results of this experiment may not hold with rations containing usual amounts of alfalfa meal.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HEYWANG, B. W.

ANTIBIOTICS AND CHICK GROWTH DURING HOT WEATHER. *Poultry Sci.*, 1959, 38, 984-985. [Animal Husb. Res. Div., Agric. Res. Serv., U.S. Dept. Agric., Glendale, Ariz.]—The amounts of antibiotics recommended by the National Research Council *(Feed Age*, 1956, 6, 43) as an addition to the rations of chicks is given as 4 g. procaine penicillin with 90 g. arsanilic acid per ton. Good results have been obtained with a combination of 1 g. procaine penicillin G and 3.75 g. of either chlortetracycline or oxytetracycline per ton (Abst. 5964, Vol. 27).

Two growth experiments were made to compare the effects of these combinations and also of 4 g. penicillin or 90 g. arsanilic acid singly or 3.5 g. erythromycin thiocyanate, an antibiotic which had not been used before. New Hampshire and New Hampshire × Cornish chickens were

used during hot weather when the maximum air temperature was 102° to 103° F. The houses and brooders had been in use for many years. Compared with controls on an unsupplemented ration, all the antibiotics improved growth rate and feed efficiency to about the same extent; the new antibiotic was no better than the others.—J. S. Thomson. (Nutrition Abstracts & Reviews)

HOGAN, A. G., and R. W. CRAGHEAD.
ESSENTIAL CONSTITUENTS OF A PRACTICAL RATION FOR BABY CHICKS. *Missouri Agric. Exp. Stat. Res. Bull.* No. 691, February 1959, pp. 19.—Experiments were made to ascertain to what extent a practical ration could be simplified without decreasing the growth rate. Growth was satisfactory on a ration of maize and soya bean meal containing 20 per cent. protein, supplemented with vitamins A, D, B_{12}, riboflavin and minerals. Adding dried whey, meat-and-bone scraps, fishmeal, maize gluten, wheat offal or alfalfa meal did not increase growth. The data indicated that neither methionine nor animal protein need be added to an all-vegetable diet if a liberal amount of vitamin B_{12} was added. The improvement of growth obtained by supplementing the maize and soya bean oilmeal diet with a combination of methionine, pantothenic acid, nicotinic acid, folic acid and choline was regarded as of questionable significance. If the breeders' diet contained adequate amounts of vitamin B_{12} the chicks stored enough of the vitamin to suffice for several weeks, but if the starter diet contained iodinated casein, supplements of vitamin B_{12} were necessary.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

HOHLS, H. W. Der Einfluss des Kalorieneiweissverhaltnisses auf die Rohverwertung bei wachsenden Huhnern.
INFLUENCE OF THE CALORIE TO PROTEIN RATIO ON FEED EFFICIENCY OF GROWING CHICKENS. *Arch. Geflugelk.*, 1958, 22, 395-415. [Bundesforschungsanst. Kleintierz., Celle.] English summary.—In 3 experiments chicks received rations differing in energy value per g., protein content and energy : protein ratio, and heat increment and deposition of protein were estimated from respiration trials twice a week.

At constant protein concentration the feed efficiency of a ration rose with increasing energy to protein ratio, but at constant energy content feed efficiency rose at first with increasing energy to protein ratio, then reached a peak and thereafter fell. The best energy : protein ratio rose with the energy value of the ration. For feed mixtures of the same energy value, feed efficiency depends in the first place on maximum capacity for deposition of protein (see Abst. 4984, Vol. 29).

For earlier work see Absts. 676, 1693, 1694, Vol. 29.—D. Duncan. (Nutrition Abstracts & Reviews)

HOHLS, H. W. Fischpulpe als Trager tierischen Eiweisses in der Kukenmast.
FISH PULP AS SOURCE OF ANIMAL PROTEIN IN FATTENING CHICKENS. *Arch. Geflugelk.*, 1959, 23, 153-165. [Bundesforschungsanst, Kleintierzucht, Celle.] English summary.—Fish pulp, obtained by cold processing of whole fish, was used experimentally as a substitute for codmeal in fattening rations for Cornish × White Rock and Nichol chickens up to 10 weeks. The rations contained 14.23 to 20.56 per cent. crude protein. Weight gains and g. feed per g. weight gain were estimated but were not entirely reliable criteria for assessing the relative merits of the products. Intake of feed and deposition of protein increased when fish pulp was used. It improved also the digestibility coefficient of fat and N-free extract, but not of crude protein, and the financial return per bird. Energy in the carcase, slaughter loss and price per kg. slaughter weight were not affected. It was more economical to give a feed mixture containing about 17, rather than 20, per cent. crude protein. Performance of the breeds of chickens is compared.—I. R. Anderson. (Nutrition Abstracts & Reviews)

HURLEY, W. C., O. J. KAHLENBERG, E. M. FUNK, L. G. MAHARG, and N. L. WEBB.
FACTORS AFFECTING POULTRY FLAVOR. 1. INORGANIC CONSTITUENTS. *Poultry Sci.*, 1958, 37, 1436-1440. [Poultry Husb. Dept., Univ. Missouri, Columbia.] (Nutrition Abstracts & Reviews)

JOHNSON, D. (Jr.), G. A. LEVEILLE, and H. FISHER.
INFLUENCE OF AMINO ACID DEFICIENCIES AND PROTEIN LEVEL ON THE PLASMA CHOLESTEROL OF THE CHICK. *J. Nutrition*, 1958, 66, 367-376. [Dept. Poultry Sci., Rutgers Univ., New Brunswick, N.J.]—Soya bean protein at 10, 25 and 40 per cent. in the diets of day-old chicks gave weight gains of 55, 154 and 190 g. in 3 weeks and final plasma cholesterol values of 371, 226 and 178 mg. per 100 ml., respectively. Added methionine improved growth and gave a significantly lower plasma cholesterol value with the lowest protein intake.

Higher growth rates and lower plasma cholesterol levels resulted when the soya bean meal at 15 per cent. was heated or a supplement of 0.2 per cent. methionine was given, and especially when the meal was heated and methionine was added.

Chicks 7 days old were given diets with 10, 25 or 40 per cent. casein alone or with extra arginine or methionine or both. With the lowest protein intake methionine only slightly improved weight gains; arginine was much more effective but less good than both amino-acids together. With 25 per cent. casein, methionine only slightly improved gains and arginine alone was as good as both. With 40 per cent. casein, arginine or both amino acids slightly improved gains, but methionine alone depressed them. At the 2 lower levels arginine was more effective than methionine in reducing plasma cholesterol, but the lowest values were found with 40 per cent. casein, especially with the double supplement. The results suggest that protein and methionine exert separate effects on serum cholesterol and that these effects are not necessarily related to growth.

A diet with 75 per cent. protein given to week-old cockerels gave a highly significant fall of plasma cholesterol but no significant difference of weight gain compared with a normal 25 per cent. protein diet.

With 25 per cent. of a protein deficient in lysine or tryptophan, addition of the missing amino acid had no effect on plasma cholesterol although growth responses were highly significant. Addition of 2 per cent. cholesterol to a diet well balanced in protein and amino acids gave a very slight rise of serum cholesterol, but at a low protein level a large rise.—S. Weir. (Nutrition Abstracts & Reviews)

JOWSEY, J. R., F. D. COOK, and H. I. MAC GREGOR.
THE EFFECT OF ROUTE OF ADMINISTRATION UPON GROWTH RESPONSE TO PENICILLIN BY TURKEY POULTS. *Canad. J. Animal Sci.*, 1959, 39, 21-25. [Canada Dept. Agric., Swift Current, Sask.]—Day-old poults were given for 4 weeks a starter diet alone or with 7 p.p.m. procaine penicillin, or had weekly intramuscular or intraperitoneal injections of 60,000 units of penicillin. The growth response to penicillin was significant and was similar with all methods of administration. In every instance penicillin reduced the lactobacillus counts in the small intestine, but injections twice weekly reduced the counts more effectively than the same amount once weekly. Coliform counts decreased when penicillin was given by mouth, but not when it was injected. When a single intramuscular dose of 60,000 units of penicillin was given to poults reared on the starter diet alone, the amount of penicillin in the small intestine 1 hr. later was 9 units per g. wet contents; 3 hr. later it was about 2 units. This level of activity persisted for 7 days and was of the order found in poults given a diet containing 7 p.p.m. penicillin.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

KARAPETJAN, S. K., and N. G. MIKAELJAN. Aminokislotnyj sostav jaicnyh belkov pri razlicnyh uslovijah soderzanija ptic.

AMINO ACID COMPOSITION OF EGG PROTEINS IN DIFFERENT CONDITIONS OF MAINTENANCE OF THE BIRDS. *Dokl. Akad. Nauk SSSR*, 1959, 126, 200-202. [Inst. Fiziol., Akad. Nauk Armjansk. SSR.]—Paper chromatography revealed no difference in amino acid composition of the white or yolk proteins of eggs obtained from hens kept in battery cages or in runs but fed on the same rations. It is concluded that battery housing has no ill effect on composition of egg protein.—D. Duncan. (Nutrition Abstracts & Reviews)

KIVIMAE, A. Forsok med konsttorkat homjol till kycklingar.
TRIALS WITH ARTIFICIALLY DRIED HAY MEAL FOR CHICKENS. *Kungl. Lantbrukshogsk. Statens Husdjursforosok Sartryck* No. 129, 1958, pp. 18. English summary.—In the first trial feed intake and growth for 8 weeks of White Leghorn chickens given rations with 6 per cent. lucerne meal, red clover meal, dandelion meal, grass meal or 2.5 per cent. straw meal with or without synthetic vitamin A supplying 4250 I.U. per kg. feed were studied. With 2.5 per cent. straw meal without supplementary vitamin A growth to 3 weeks was normal, but then rate of gain rapidly declined and clear signs of vitamin A deficiency appeared, and mortality was high. Those given 10,000 I.U. vitamin A per kg. feed at 4 weeks recovered quickly; in those not given the vitamin supplement, growth ceased at 5 weeks and all died by 7 weeks. Of the hay meals grass meal gave the highest values for carotene in the liver, and lucerne meal the lowest. Straw meal and the vitamin A supplement was almost as good as lucerne; the subgroup given vitamin A after 4 weeks had the highest value recorded. Intensive yellow colouration of skin of the legs due to xanthophyll was seen in chickens getting the hay meals.

In the next trial lasting 8 weeks chick rations with 4, 8 or 12 per cent. lucerne meal were compared. Weight gains were lower than in the first trial and fell with increasing amounts of lucerne meal; feed intake per kg. gain was similar in the groups getting 4 and 12 per cent. lucerne meal, 3.02 kg., but 3.27 kg. in the groups getting 8 per cent. Mortality was low, but chickens getting 8 and 12 per cent. lucerne meal did not seem to thrive; the failure was considered to be due to increased amounts of fibre and of growth-inhibiting substances from the lucerne meal.

In a third trial 7 groups of chickens were given rations with 5 per cent. lucerne meal or grassmeal, or 0.0008 per cent. synthetic β-carotene, 0.03 per cent. synthetic vitamin A, 0.36 per cent. fish liver oil and 0.6 per cent. annatto, or 0.03 per cent. synthetic vitamin A and the ash of 5 per cent. lucerne meal or grassmeal. The content of esential nutrients and vitamins was the same in all rations. General health was good in all. Weight gains were as high as in the first trial and there was no significant difference between groups or sexes. Leg colour was intense yellow in chickens getting green meals, pale grey in others, and the colour was not improved by annatto. Feed intake per kg. gain was the same for most groups, but was higher in the groups getting lucerne meal ash or grassmeal.—R. G. Hankin. (Nutrition Abstracts & Reviews)

KLEIN, F. W. Wie die Saat—so die Ernte!
AS YE SOW, SO SHALL YE REAP. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 147-153.—A general account of the proper housing, heating and feeding of chicks from hatching. (Nutrition Abstracts & Reviews)

KLIMES B. Zabezpeceni vitaminu D pro drubez v intenzivnich odchovech.
ENSURING VITAMIN D FOR POULTRY IN INTENSIVE BREEDING. *Veterinarstvi*, 1959, 9, 105-107. [1. Int. Clin., Vet. Fac., Agric. Univ., Brno.]—In large-scale poultry production deficiency of vitamin D is one of the principal causes of chick mortality and loss of eggs by breaking. Chickens and young turkeys are more liable to rickets than ducks, geese or pigeons. The best form is vitamin D_3. Requirements in I.U. per kg. feed daily are: for chickens 180 to 300, for laying hens 550 to 750, for young and adult turkeys 800 to 1200, for ducks 200 to 600, for geese 400. In adult birds vitamin D deficiency

is shown in the number of eggs with thin and soft shells. There are great differences in the estimates in the literature of the sunshine necessary to prevent vitamin D deficiency, from 5 min. to 7 hr. daily. The simplest preventive is to add synthetic vitamin D_3 to the feed.—A. Jancarik (Czechoslovakia). (Nutrition Abstracts & Reviews)

KRATZER, F. H., J. B. ALLRED, P. N. DAVIES, B. J. MARSHALL, and **P. VOHRA.**

THE EFFECT OF AUTOCLAVING SOYBEAN PROTEIN AND THE ADDITION OF ETHYLENEDIAMINETETRACETIC ACID ON THE BIOLOGICAL AVAILABILITY OF DIETARY ZINC FOR TURKEY POULTS. *J. Nutrition*, 1959, 68, 313-322. [Dept. Poultry Husb., Univ. California, Davis.]—Turkey poults were given a basal ration containing isolated soya bean protein, cellulose, soya bean oil, vitamins and minerals other than Zn. The Zn content of the ration was 25.5 p.p.m. Growth was poor, but was improved by 60 p.p.m. added Zn or by autoclaving the soya bean protein. The Zn derivative of ethylenediamine tetra-acetic acid (EDTA) or EDTA added alone increased growth, and EDTA, if given in large amounts, also reduced perosis. Optimum growth and prevention of perosis were obtained only with 150 p.p.m. Zn, but with less when EDTA was given. The ratio of the width of the tarso-metatarsus to its length was significantly reduced by supplements of either Zn or EDTA.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

LAKSESVELA, B. Beeinflusst der Gehalt an freien Fettsauren die Heringsmehlqualitat?

DOES THE CONTENT OF FREE FATTY ACIDS AFFECT THE QUALITY OF HERRING MEAL? *Arch. Geflugelk.*, 1959, 23, 88-100. [Tjaerevikon, Norway.] English summary. — Chickens were given rations with from 14 to 16.2 per cent. herring meal. The first group received a meal with a high content of free fatty acids, the second one with 60 per cent. less and the third a meal from which fat had been extracted and to which 0.6 per cent. groundnut oil was added. Weight gains were similar in all groups but feed efficiency was worst in the second group.

Rations containing herring meal with a high or a low fatty acid content or a ration with no animal protein were given to 3 groups of pigs. Weight gains were highest and feed utilisation best, though not significantly so, on the meal high in fatty acids.

In trials with chickens 12 herring meals with from 0 to 47.8 per cent. free fatty acids in the fat were compared. Best protein utilisation was with a low content of free fatty acids, but there were wide variations. In further trials with herring meal as the only source of protein, no relation was found between free fatty acid content and protein utilisation. It is concluded that differences between meals were due to their amino acid composition and not to their content of free fatty acids. High levels of free fatty acids produced no ill effect, and did not affect the flavour of the meat. Free fatty acid content is not considered a useful criterion of the quality of a herring meal.—R. G. Hankin. (Nutrition Abstracts & Reviews)

LANDAU, L., V. PETER, and **A. SPRONC.** Pokus s intenzivnym vykrmom mladych moriek systemom "brollerov" u hrabavej hydiny.

HIGH-EFFICIENCY BROILER RATIONS FOR YOUNG TURKEYS. *Poľnohospodarstvo*, 1959, 6, 377-402. [Poultry Res. Inst., SAV, Ivanka pri Dunaji, Czechoslovakia.] German and Russian summaries.—Three experiments with a total of 375 turkey poults, reared to 112 days of age under similar housing conditions, are reported. In each experiment the ration for the control group was, per cent., meat-meal 8, yeast 3, wheat bran 15, ground barley or wheat 28, ground maize 17, ground polished rice 13, soya bean and groundnut meal 10, wheat germ 3 and minerals 3. For the experimental groups the ration was, per cent., ground maize 40, soya bean oilmeal 40, fishmeal 5, meat-

meal 3, blood meal 1, brewer's yeast 6, dried lucerne meal 2, mineral mixture 3, with added antibiotics and vitamins. The experimental diet was given from the 5th, 12th and 19th day of life in the 3 experiments, respectively. At the end of the experiments liveweights of experimental groups compared with controls as 100 per cent., in the respective trials, were 157, 143, and 128 per cent. Average daily weight gains were significantly higher in the experimental groups by 74.9, 44.6 and 30.4 per cent. Feed required per kg. gain was 3.71, 3.51 and 3.81 kg., 78.8, 87.5 and 89.2 per cent. that of controls in the 3 trials, respectively. Average dressed carcase weight was 1217 and 1913 g., with 644 and 1068 g. lean meat, for controls and experimental birds, respectively.—M. Proksova (Czechoslovakia). (Nutrition Abstracts & Reviews)

LEACH, R. M. (Jr.), R. DAM, T. R. ZIEGLER, and **L. C. NORRIS.**

THE EFFECT OF PROTEIN AND ENERGY ON THE POTASSIUM REQUIREMENT OF THE CHICK. *J. Nutrition*, 1959, 68, 89-100. [Dept. Poultry Husb., Cornell Univ., Ithaca, N.Y.]—First-cross male chicks were used. On the basal purified diet with 30 per cent. crude protein and 3.68 Cal. metabolisable energy per g., and 0.26 per cent. Na, it was shown that the potassium requirement for optimum growth was 0.30 per cent. and 0.20 per cent. was required to prevent excessive mortality. With diets with from 25 to 37 per cent. protein the K requirement increased with increasing protein, but not proportionally. When the energy content of the diet was changed by manipulation of the amount of maize oil the requirement was positively and proportionally related to the energy level of the diet but not to the fat content, and the K requirement was less in older birds.—J. G. Gordon. (Nutrition Abstracts & Reviews)

LEMACK, N. I., G. E. LIVINGSTON, L. R. PARKINSON, C. R. FELLERS, and **D. L. ANDERSON.**

EXPLORATORY RAT AND CHICK BIOASSAYS OF SCALES FROM OCEAN PERCH AND HERRING AS ANIMAL FEED. *Food Res.*, 1958, 23, 684-692. [Dept. Food Technol., Univ. Massachusetts, Amherst.]—In trials lasting 6 weeks groups of rats were given rations in which the sole source of protein was casein or dried ocean perch scales or a pepsin hydrolysate of dried ocean perch scales. Neither the raw scales nor the hydrolysate supplied sufficient protein to sustain life. In further trials some rats received fishmeal to provide 90 or 70 and dried ocean perch or herring scales to provide 10 or 30 per cent. of the protein and controls were given fishmeal as sole source of protein. Rations containing ocean perch scales to supply 30 per cent. of the protein significantly reduced growth; there was no other adverse effect.

Six groups of 16 chicks were given for 3 weeks rations with soya bean meal or fishmeal as the chief source of protein or fishmeal to supply 75 or 50 and dried ocean perch or herring scales to provide 25 or 50 per cent. of the protein. Growth was significantly reduced when scales provided 50 per cent. of the protein.

It is suggested that the maximum safe level for addition of fish scales to fishmeal is between 10 and 30 per cent. of dietary protein for ocean perch scales and at or above 30 per cent. for herring scales. Further research on the effect of fish scales on feed efficiency is desirable.—R. G. Hankin. (Nutrition Abstracts & Reviews)

LEV, M., and **M. FORBES.**

GROUP RESPONSE TO DIETARY PENICILLIN OF GERM-FREE CHICKS AND OF CHICKS WITH A DEFINED INTESTINAL FLORA. *Brit. J. Nutrition*, 1959, 13, 78-84. [Germ-free Animal Res. Unit, Walter Reed Army Inst. Res., Washington, D.C.]—Germ-free chickens experimentally infected with *Clostridium welchii* alone or with *Streptococcus liquefaciens*, *Bacterium coli* and *Lactobacillus lactis* or with the last 3 only were reared in germ-free units and were offered a sterilised semi-synthetic diet with or without sterilised procaine penicillin G, 45 mg. per kg. feed. Changes in the bacterial counts in different

parts of the intestine and changes in bodyweight were measured.

Cl. welchii, which was found chiefly in the caecum, depressed the growth rate of chicks. The effect was counteracted by penicillin, either by elimination of the clostridia or by reducing their toxicity. The other bacteria did not directly affect growth rate; when present with *Cl. welchii* they apparently reduced its numbers and hence its depressing effect. Penicillin did not influence growth rate except when growth had been reducel by the clostridia.—J. G. Gordon. (Nutrition Abstracts & Reviews)

LEVEILLE, G. A., and H. FISHER.

THE AMINO ACID REQUIREMENTS FOR MAINTENANCE IN THE ADULT ROOSTER. 1. NITROGEN AND ENERGY REQUIREMENTS IN NORMAL AND PROTEIN-DEPLETED ANIMALS RECEIVING WHOLE EGG PROTEIN AND AMINO ACID DIETS. *J. Nutrition*, 1958, 66, 441-453. [Dept. Poultry Sci., Rutgers Univ., New Brunswick, N.J.]—1. Birds not previously depleted of protein were given for one week a basal diet sufficient to maintain positive N balance, to standardise the protein reserves. Other birds were depleted on N-free diet for 7 days. Experimental diets were then given forcibly during 3-day balance periods. In non-depleted birds given, as source of N, whole egg protein or a mixture of free amino acids based on the composition of whole egg protein, 280 mg. N per kg. daily was required to maintain positive N balance; in birds depleted of protein 140 mg. On a diet containing whole egg protein, the metabolisable energy requirement was 90 Cal. per kg. per day, compared with 110 to 115 Cal. on the amino acid diet. The endogenous N excretion, 143 mg. per kg. per day, was reached after 3 days on N-free diet. The minimum N requirement, based on this figure, was 2.2 mg. N per calculated basal Calorie per day. The importance of considering the protein reserves of the bird when interpreting N balance data is emphasised.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

LOBIN, N. V. Znacenie kukuruzy v kormlenii pticy.

IMPORTANCE OF MAIZE IN POULTRY FEEDING. *Ptitsevodstvo*, 1959, No. 3, 13-16. (Nutrition Abstracts & Reviews)

LOBIN, N. V. Kormlenie mjasnyh cypljat.

FEEDING CHICKENS FOR MEAT. *Pticevodstvo*, 1959, No. 6, 27-29. (Nutrition Abstracts & Reviews)

LUCAS, J. M. S.

TOXIC EFFECTS PRODUCED BY PYRIMETHAMINE IN CHICKENS AND THEIR ANTAGONISM BY FOLIC ACID. *Nature*, 1958, 182, 1449. [Vet. Res. Stat., May and Baker, Ltd., Ongar.]—When the folic acid antagonist pyrimethamine was used with sulphaquinoxaline to prevent caecal coccidiosis in chicks, growth rate fell and macrocytic hyperchromic anaemia occurred. These changes could be prevented by folic acid, 100 mg. per kg. bodyweight, injected twice weekly. The toxic effects reported from the use of pyrimethamine appeared to be due to deficiency of folic acid.—A. M. Copping. (Nutrition Abstracts & Reviews)

MACHLIN, L. J., R. S. GORDON, and K. H. MEISKY.

THE EFFECT OF ANTIOXIDANTS ON VITAMIN E DEFICIENCY SYMPTOMS AND PRODUCTION OF LIVER "PEROXIDE" IN THE CHICKEN. *J. Nutrition*, 1959, 67, 333-343. [Monsanto Chemical Co., St. Louis, Mo.]—Day-old crossbred cockerels were fed on a basal diet for one week and were then divided into equal groups and fed on one of 3 different vitamin-E-deficient diets with or without an anti-oxidant. The diets contained purified casein, gelatine or an isolated soya bean protein, lard, salts and vitamins. Lard formed 4 per cent. of one diet and 16 per cent. of the others. After 3 weeks on the diets all chicks developed encephalomalacia even though their dams were not

depleted of vitamin E. Inclusion of 0.10 per cent. of Santoquin, 1 : 2-dihydro-6-ethoxy-2 : 2 : 4-trimethylquinoline, in the diet completely prevented muscular degeneration in the chicks fed on a diet containing less than 0.09 I.U. vitamin E per lb. Other anti-oxidants examined were calcium DL-2-hydroxy-4-methylthiobutyrate, 2 : 6-di*tert*.butyl-*p*-cresol and lauroyl peroxide. Santoquin prevented encephalomalacia and exudative diathesis with diets containing less than 0.36 I. U. vitamin E per lb.

The diets were examined for "peroxide" (oxidised unsaturated fatty acids); signs of vitamin E deficiency were produced in birds receiving diets in which there was no detectable oxidative rancidity. By a thiobarbituric acid colorimetric procedure "peroxide" formation was found also in liver homogenates of the chicks given the deficient diets. Vitamin E or Santoquin added either to the diet or directly to the homogenates prevented the formation of liver "peroxide". It is concluded that in the chicken the requirement of vitamin E can be largely satisfied by a biologically active anti-oxidant. I. M. Sharman. (Nutrition Abstracts & Reviews)

MACHT. Vitamine und Antibiotika in der Geflugelfutterung.

VITAMINS AND ANTIBIOTICS IN POULTRY DIET. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 636. [Kitzingen.]—Young Leghorn hens, 20 in each group, were given basal diet with carrots and cod liver oil or with synthetic vitamins (Hamisan concentrate). Laying and hatching results were about the same for both groups. The relatively high cost of synthetic vitamins was, to some extent at least, outweighed by economy of time and effort.

Other hens getting a basal ration with terramycin, 0.15 per cent., gave better hatching than hens receiving a vitaminised protein concentrate. Even with antibiotic, laying results were poor unless half of the protein was given as animal protein.

During 3 months 2 further groups, of 200 each, had supplements of cod liver oil alone, 1 g. per hen daily, or aureomycin, 80 mg. per kg. laying meal, with vitamins of the B group, A and D_3. Aureomycin improved the hatching results, especially in January and February when the birds were kept indoors without access to the grass run.—I. R. Anderson. (Nutrition Abstracts & Reviews)

MACKROTT, H. Zur Futterung der Legehennen mit Alleinfutter.

FEEDING LAYING HENS ON ALL-MASH DIET. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 572-575; 577. [Uetersen.]—A review with 18 references. (Nutrition Abstracts & Reviews)

MAHADEVAN, S., S. KRISHNAMURTHY, and **J. GANGULY.**

STORAGE OF VITAMIN A ESTER, VITAMIN A ALCOHOL AND OF CAROTENOIDS IN ASSOCIATION WITH PROTEINS IN CHICKEN LIVER. *Indian J. Med. Res.*, 1959, 47, 199-206. [Dept. Biochem., Indian Inst. Sci., Bangalore.]—Vitamin A, carotenoids and cholesterol could not be extracted from chicken liver homogenate by petroleum ether, diethyl ether or benzene unless the solvent contained 25 per cent. ethanol. Extractability of vitamin A by diethyl ether rose with decrease of *p*H, but extractability of carotene decreased below *p*H 6. Lower concentrations of ethanol and Na salicylate were required for complete extraction of the vitamin ester than for the vitamin alcohol or carotenoids. Extraction of the homogenate with *M* NaCl to remove phospholipids did not remove carotenoids or cholesterol.—J. Quarterman. (Nutrition Abstracts & Reviews)

MANCINI, F., and A. BIGIOTTI. Valore nutritivo di una pasta alimentare integrata con uova.

NUTRITIVE VALUE OF A PASTA MIXED WITH EGG. *Boll. Soc. ital. Biol. Sper.*, 1958, 34, 1855-1860. [Ist. Naz. Nutriz. C.N.R., Rome.]—Rats, male and female, mainly in groups of 10 or 14, were given pasta alone or with 5 or 2 eggs per kg. Protein content of the pasta alone, 11 per cent., was raised to 15 per cent. by addition of 5 eggs.

Other rats received flour pasta with added gluten, protein content 15 per cent. Survival, weight gain and general condition of all rats given egg, especially at the higher rate, were excellent. Results for the others were poor. In a metabolism experiment by Mitchell's method the pasta containing 5 eggs was given to 4 male rats; its biological value was 92.—I. R. Anderson. (Nutrition Abstracts & Reviews)

MARCH, B. E., and J. BIELY.
THE SPARING EFFECT OF WHEAT ON THE NEED FOR PROTEIN CONCENTRATES IN A TURKEY STARTING RATION. *Canad. J. Animal Sci.*, 1958, 38, 118-121. [Poultry Nutrit. Lab., Univ. British Columbia, Vancouver.]—Poults were given rations which differed only in their content of wheat, maize and soya bean oilmeal. It was found that the extra protein in wheat containing 14.3 per cent. protein, compared with a wheat containing 12.7, could effectively replace an equivalent amount of protein from soya bean oilmeal. Similarly, when the rations contained wheat, less supplementary protein was required than if maize, with 8.6 per cent. protein was used. Feed efficiency and rate of growth on wheat and maize diets were similar.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

MARTINA, C., M. STEFANESCU, and C. ALEXANDRU. Substituirea ovazului prin mei in hrana gainilor si a puilor.
REPLACEMENT OF OATS BY MILLET IN THE RATIONS OF HENS AND CHICKENS. *Lucr. Stiint. Inst. Cercet. Zooteh., Bukarest*, 1958, 16, 581-590. Russian, French, German and English summaries.—When millet replaced 19 per cent. oats in rations for laying hens or from 23 to 28 per cent. for chickens there was no effect on growth or on broodiness, moulting or health. There were small differences in favour of millet in egg production. Fertility and hatchability of eggs were better on oats than on millet. (From English summary).—T. D. Bell. (Nutrition Abstracts & Reviews)

MAUCH, A., M. GONDOS, E. BRATU, and V. MAXIM. Influenta carotenului si vitaminei A din hrana gainilor asupra calitatii oualor pentru incubate.
INFLUENCE OF CAROTENE AND VITAMIN A IN THE FEED OF HENS ON THE QUALITY OF HATCHING EGGS. *Lucr. Stiint. Inst. Cercet. Zooteh., Bukarest*, 1958, 16, 567-579. Russian, French, German and English summaries. —In 1955 and 1956, 4 groups of 30 Rhode Island hens were given from January to April a basal ration containing little carotene, alone or with carrots 30, lucerne silage 30 or cod liver oil 1 g. per hen daily. Eggs were hatched in monthly sets of 400.

In the 4 groups, on the average for the entire period of 4 months, egg yolk contained, respectively, carotene 16.6, 20.3, 22.2 and 10.9 and vitamin A 7.3, 8.0, 8.1 and 10.1 μg. per g. The percentage of fertile eggs was 74.1, 81.1, 84.2 and 84.7 and the hatching percentage 65.2, 74.8, 71.4 and 79.0. In the unsupplemented group values fell sharply after the second month, until in the fourth month egg yolk contained carotene 10.1 and vitamin A 4.2 μg. per g. and the percentages of fertile and of hatched eggs were, respectively, 65.0 and 56.7.—I. R. Anderson. (Nutrition Abstracts & Reviews)

MC DANIEL, A. H., J. H. QUISENBERRY, B. L. REID, and J. R. COUCH.
THE EFFECT OF DIETARY FAT, CALORIC INTAKE AND PROTEIN LEVEL ON CAGED LAYERS. *Poultry Sci.*, 1959, 38, 213-219. [Dept. Poultry Sci., Texas Agric. Exp. Stat., College Station.]—For 24 weeks from the beginning of lay, Leghorn pullets were given rations with 15, 20 or 25 per cent. protein, each supplying 750 or 960 Cal. productive energy per lb.; extra energy for the higher level was supplied by 10 per cent. poultry oil or soya bean oil. Other rations had 15 per cent. protein and 935 Cal. per lb., 20 per cent. protein and 860 Cal. per lb., or 25 per cent. protein and 794 Cal. per lb.

As a rule the feed required per doz. eggs decreased as the energy of the ration increased. Egg production was not affected by the ration. Poultry oil had a more favourable effect on egg production and on efficiency of egg production than soya bean oil.

There were significant increases of total serum cholesterol as protein increased and the increase was greater with poultry oil than with soya bean oil. Average liver weight for all groups was 30.3 g. and, with few exceptions, protein or level or source of energy had no significant effect. The amount of fat in the liver was not affected by level of either energy or protein except for a high value with 15 per cent. protein and 935 Cal. There was a high incidence of fatty liver except with the 15 per cent. protein and 750 Cal. diet; the presence of fat in the ration, either animal or vegetable, did not affect the fatty liver condition. Large amounts of abdominal fat were found, corresponding in degree and incidence to the fatty liver condition. Fatty encapsulation of the kidney was seen in hens with normal or excessive amounts of abdominal fat, but the kidneys showed no fatty infiltration. Atherosclerotic conditions found in the arteries were not related to either the protein or the energy levels of the rations and observed morphological changes were not related to serum cholesterol levels. Total serum cholesterol was significantly and positively correlated with liver weight percentage of liver fat, serum lipid P, total serum protein and total serum albumin.—J. S. Thomson (Nutrition Abstracts & Reviews)

MC DONALD, W. M. [M. W.]

BASIC EXPERIMENTS WITH METHIONINE IN COCKEREL DIETS. *Agric. Gaz. N.S.W.*, 1958, 69, 552-556. [Poultry Exp. Stat., Seven Hills, N.S.W.]—Supplements of 0.05 to 0.2 per cent. methionine added to diets low or high in energy improved growth of Leghorn cockerels, particularly on the high-energy diets, and efficiency of feed utilisation. Australorps did not respond to methionine supplements, but both Leghorns and Australorps increased significantly in weight after supplements of cystine. The growth response of Leghorns to cystine and to methionine was similar. It is concluded that the diets were lacking in cystine and that Leghorns could synthesise cystine from methionine but Australorps could not.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

MELESKO, K. V. Soderzanie kobal'ta v piscevyh produktah zivotnogo proishozdenija.

COBALT CONTENT OF FOODS OF ANIMAL ORIGIN. *Vop. Pitan.*, 1959, 18, No. 1, 57-61. [Med. Stomatol. Inst., Moscow.] English summary.—In 25 meats and meat products the highest mean Co values were 11.45, 13.53 and 14.84 μg. per 100 g. in pig, ox and sheep liver, respectively. Similarly in 19 fish and fish products and 6 dairy products values were Siberian salmon 4.32, Caspian salmon roe 5.60 and Russian cheese 4.32. Values for yolk, white and whole egg were 2.50, 1.37 and 2.03 μg. per 100 g., respectively.—R. G. Hankin. (Nutrition Abstracts & Reviews)

MELLOR, D. B., P. A. STRINGER, and G. J. MOUNTNEY.

THE INFLUENCE OF GLYCOGEN ON THE TENDERNESS OF BROILER MEAT. *Poultry Sci.*, 1958, 37, 1028-1034. [Texas Agric. Exp. Stat., College Station.]—*d*-Glucose was given for 48 hr. to groups of White Rock broiler chickens as 20 to 100 per cent. of the ration. There was a loss of bodyweight when more than 55 per cent. was given. The highest amount of sugar consumed, 83 g., was also with 55 per cent.

In a comparison of the glycogen content of fresh and frozen muscle tissue there was less glycogen in the frozen. Glycogen was estimated in the pectoralis major muscle of groups of broilers which for 16 hr. before slaughter had access to neither feed nor water, had access to water but not to feed, had access to water and a broiler mash or had access to water and a broiler mash containing 55 per cent. sugar. Glycogen tended to be higher in the fasted groups and lowest in the group given the

mash containing sugar. Shear values of the cooked flesh were significantly lower in 18 samples with high glycogen content than in 18 with low values. In the carcases with the highest glycogen content the *p*H of muscle decreased from an initial value at slaughter of 6.4 to 5.9 before cooking after freezing and thawing. In the carcases with the lowest glycogen content there was no such change. in *p*H.—J. S. Thomson. (Nutrition Abstracts & Reviews)

MILLER, E. C., and C. A. DENTON.
FEATHER DEPIGMENTATION RESULTING FROM FEEDING MOLYBDENUM PLUS THIOSULFATE. *Proc. Soc. Exp. Biol. Med.*, 1959, 100, 179-183. [U.S. Dept. Agric., Animal Husb. Res. Div., Beltsville, Md.]—Chicks were given a basal diet containing Mo 3 and Cu 13 p.p.m., supplemented with Mo, or sodium thiosulphate labelled with ^{35}S, or both. There was depigmentation of feathers when both were added to the diet, but not with either supplement alone. Addition of lysine or vitamins did not prevent depigmentation. Livers of chicks showing depigmentation contained more Cu, Mo and ^{35}S than those of chicks on the basal diet, alone or supplemented with Mo or thiosulphate. Since addition to the diet of Cu, 50 p.p.m., prevented depigmentation, the Cu in the liver tissue apparently was not available, possibly owing to the formation of a Cu-Mo-thiosulphate complex. In chicks given thiosulphate-^{35}S, radio-activity was found in taurine but not in methionine or cystine fractions of liver hydrolysates.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

MILLER, E. C., and C. A. DENTON.
MOLYBDENUM-SULFATE INTERRELATIONSHIP IN THE GROWING CHICKS. *Poultry Sci.*, 1959, 38, 910-916. [U.S. Dept. Agric., Animal Husb. Res. Div.]—In 6 experiments with chickens addition to a basal ration of 2200 p.p.m. sulphate as Na and K salts had no effect on growth after 3 weeks. More, 13,200 p.p.m., caused slight depression. Addition to the basal ration of 200 p.p.m. Mo had no effect on growth, but with 500 p.p.m. there was slight depression and at 1500 and 2250 p.p.m. depression was considerable. Where Mo depressed growth, sulphate partly counteracted the depression. In a test with other S-containing compounds, inorganic sulphate was more effective in preventing depression of growth by 1500 p.p.m. Mo than methionine, taurine, bisulphite, sulphite, or sulphide. Thiosulphate did not counteract the depression, and caused further depigmentation. At high levels of Mo, storage of Mo in the liver was reduced when sulphate was added to the diet, and still further when Cu was added also, but Cu did not improve growth rate. Injection of sulphate-^{35}S showed that addition of Mo to the diet did not increase the rate of sulphate excretion. All groups given the sulphate supplement, with or without Mo, excreted more ^{35}S than controls. The distribution of ^{35}S in organic and inorganic fractions of the liver was not affected by adding Mo and sulphate to the ration; the greater part of the radio-activity was found in the taurine fraction.—J. S. Thomson. (Nutrition Abstracts & Reviews)

MILLER, M. M., and J. H. QUISENBERRY.
FACTORS AFFECTING FEED EFFICIENCY FOR EGG PRODUCTION IN SELECTED STRAINS OF CAGED LAYERS. *Poultry Sci.*, 1959, 38, 757-766. [Dept. Poultry Sci., Texas Agric. and Mech. Coll. System, College Station.]—(Nutrition Abstracts & Reviews)

MOHAN, V. S., B. L. REID, and J. R. COUCH.
CHEMICAL METHOD FOR ESTIMATION OF NIACIN IN POULTRY FEEDS AND PREMIXES. *J. Agric. Food Chem.*, 1959, 7, 42-44. [Dept. Poultry Sci., Texas Agric. and Mech. System, College Station.]—Two g. of a mash containing 25 to 45 mg. nicotine acid per lb. was autoclaved with 40 ml. *N* H_2SO_4 at 15 lb. presssure for 30 min. The cooled extract with 5 g. anhydrous Na_2SO_4 or 8 g. $(NH_4)_2SO_4$ was shaken occasionally for 15 min., then filtered. The filtrate was diluted and de-

colourised with 1 per cent. $KMnO_4$ and the *p*H was adjusted to 6.5 to 6.8. Two g. of a pre-mix containing 1600 to 3300 mg. nicotinic acid per lb. was similarly extracted and the filtrate was greatly diluted so that decolourisation was unnecessary. For colorimetry a portion containing 3 to 6 μg. nicotinic acid was heated at 75° to 80° C. for 5 min. and then for 5 min. with 3 per cent. CNBr. Aniline hydrochloride solution was added to the cooled solution and the colour was measured at 420 mμ. within 3 min. Values agreed well with those obtained by the A.O.A.C. microbiological method.—A. Hepburn. (Nutrition Abstracts & Reviews)

MONE, P. E., W. D. WARNER, C. E. POLING, and **E. E. RICE.**

INFLUENCE OF DIETARY FAT AND PROTEIN ON SERUM CHOLESTEROL OF CHOLESTEROL-FED CHICKS. *J. Amer. Oil Chem. Soc.*, 1959, 36, 141-142. [Res. Labs., Swift and Co., Chicago, Ill.]—Chicks which had received for 21 days a good mixed ration were given experimental diets modified to contain 19 or 25 per cent. protein and 4 or 10 per cent. cottonseed oil or maize oil or partly hydrogenated cottonseed oil. The two levels of fat provided diets with an appropriate or a high energy:protein ratio. Cholesterol, 0.5 per cent., was added to all diets. Serum cholesterol was estimated initially and after 14, 24 and 38 days. Values were significantly higher in birds given less protein, whatever the amount or type of fat. In chicks given for 38 days the diet containing 10 per cent. cottonseed oil and 19 per cent. protein, serum cholesterol was higher than in any other group; otherwise serum cholesterol was not affected by increasing the fat from 4 to 10 per cent., or by the degree of saturation of the fat.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

MORIMOTO, H., M. YOSHIDA, and **H. HOSHII.**

NUTRITIVE VALUE OF VARIOUS FATTY MATERIALS ON THE GROWTH OF CHICKS. 1. *Bull. Nat. Inst. Agric. Sci., Japan* (Ser. G), 1959, No. 17, 121-131. In Japanese : English summary.—1. In a series of trials with day-old chicks supplements of soya bean oil, a by-product from the production of soya bean oil, lard, beef tallow and fresh sardine oil, all from 3 to 5 per cent. of the ration, increased growth in 4 weeks by 4 to 22 per cent. compared with that on basal rations with or without animal protein. The lecithin fraction of the oil by-product, a by-product with less oil, oil produced during the manufacture of soya sauce, and sardine oil stored for 6 months reduced growth, and mutton fat was without effect. When growth was more rapid less feed was required per lb. gain.

In digestibility trials with chickens it was shown that digestibility of fat estimated by the chromic oxide method compared well with that from total collection. It was also shown that digestibility of fat decreased as melting-point rose. (From summary and tables.)—T. D. Bell. (Nutrition Abstracts & Reviews)

MORRIS, R. H.

THE PLACE OF CLOVER MEAL IN POULTRY FEEDING. *J. Agric. W. Austral.*, 1959, 8, 289-296. [Poultry Res. Stat., Herdsman Lake.]—Experiments were made to ascertain to what extent clover meal could replace the more expensive lucerne in diets inadequate for maximum production of hens in laying cages. When these diets were supplemented with 8 per cent. clover meal, egg production was improved and a desirable deep yellow colour was imparted to the yolks. Inclusion of clover meal in rearing rations was not beneficial.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

MORRISON, J. W. C.

THE GROSS PROTEIN VALUE OF AUSTRALIAN MEAT MEALS. *J. Austral. Inst. Agric. Sci.*, 1959, 25, 63-64. [Sch. Agric., Univ. Melbourne.]—The low efficiency of broiler production in Australia was

thought to be due in part to the absence of good strains of birds but chiefly to the poor quality of the meatmeals available. Trials showed that gross protein values of 4 Australian meat-and-bone meals, estimated by the method of Heiman *et al.* (Abst. 5020, Vol. 9) were less than those of protein supplements commonly used in other countries where broiler production is more efficient.

Supplements of lysine and methionine are unlikely to prove of immediate practical value, since they cost too much.—M. E. Falconer. (Nutrition Abstracts & Reviews)

MULLER, Z. (Res. Inst. Antibiotics, Prague, Czechoslovakia) Vysledky pokusn s riboflavinem osl. vyroby u drubede.

RESULTS OF EXPERIMENTS WITH CZECHOSLOVAKIA-MADE RIBOFLAVIN IN POULTRY. *Sbornik Csazv zivocisna vyroba* 4(7), 523-534, 1959.—Results of experiments with feeding a preparation containing riboflavin produced in Czechoslovakia are described. The preparation acquired by fermentation of the strain Eremothecium ashbyi contains about 2% of riboflavin. The preparation even in very high dosage does not give any toxicity.

In the chicken diet which contained 1 mg of riboflavin the addition of the riboflavin preparation at the physiological optimum need showed a remarkable weight gain. The control group had in 4 weeks an average increment of 55.4 g per chick, whereas the riboflavin-fed group reached no less than 130 to 133.4 g. By adding riboflavin to this diet the feed consumption on one unit of increment has been lowered by more than 50%. Mortality has been markedly reduced. The control group had 40% mortality rate, the experimental group with riboflavin only 10%.

Addition of technical riboflavin has manifested itself in a statistically significant rise in weight even in good conditions of the current breeding way of chickens when feeding the standard, commercially-produced, mixtures. A favorable effect on mortality was obtained. Hens have shown in addition to a mild rise in egg production and fertility, remarkable hatchability. In this paper there is also concisely described the biogenesis of riboflavin, the manifestations resulting from lack of this vitamin and also its need based on experience both in this country and abroad.—V. Orel. (Nutrition Abstracts & Reviews)

OBENKO, K. S. Nut v kormovyh racionah cypljat.

CHICKPEAS IN THE RATIONS OF CHICKENS. *Pticevodstvo*, 1959, No. 2, 21-22.—Chickens were given the same starter ration for 20 days. They were then divided into 2 groups of 80 and to 3 months of age were given a ration of mixed cereals, meat-and-bone meal, lucerne meal and chalk or the same with the meat-and-bone meal replaced by finely ground chickpea meal, on an equivalent protein basis, which required 1.5 to 2 kg. chickpea meal per kg. meat-and-bone meal. Average weights at 20 days were 128 and 130, at 3 months 1170 and 1250 g. No difference between groups was seen in blood picture or in development of the internal organs.—R. G. Hankin. (Nutrition Abstracts & Reviews)

OLSEN, E. M., J. D. HARVEY, D. C. HILL, and **H. D. BRANION.**

EFFECT OF DIETARY PROTEIN AND ENERGY LEVELS ON THE UTILIZATION OF VITAMIN A AND CAROTENE. *Poultry Sci.*, 1959, 38, 942-949. [Dept. Nutrit., Ontario Agric. Coll., Guelph.]—The day-old chicks used were the progeny of birds fed for 4 generations on rations low in vitamin A and devoid of carotenoids.

In the first experiment two vitamin-A-deficient basal rations were used, one containing 16.9 and the other 24.6 per cent. protein, with energy values of 966 and 908 Cal. per lb., on which chicks were fed for 4 weeks without supplement or were given additional vitamin A, 200, 600 or 1200 I.U. per lb. All the chicks on the unsupplemented rations died before the end of the experiment. With the smallest vitamin A supplement the level of protein had little effect on growth. With the high-protein ration 600 I.U. gave the best growth but with the low-

protein ration the rate of growth rose with the level of vitamin A. Growth was subnormal in all groups.

Vitamin A content of liver was low with the smallest vitamin A supplement and rose with the amount of supplement. With the 2 highest supplements the amount stored in the liver was higher with the low-protein than with the high-protein ration.

In a further experiment with rations differing in the ratio of protein to energy, cereal grass was added to provide carotene equivalent to 600 or 1200 I.U. vitamin A. Growth to 4 weeks of age and efficiency of use of feed were better with the rations containing less carotene. With rations containing 26, 22 or 17 per cent. protein, each with an energy value of about 845 Cal. per lb., carotene and vitamin A content of the liver varied with protein intake, confirming the result of the first experiment in which vitamin A was given. With rations of medium protein content, 20 to 22 per cent., but with energy values of 1034, 853 and 717 Cal. per lb. the amount of vitamin A stored in the liver was directly proportional to the energy per lb. ration, a result difficult to reconcile with reduced consumption of high-energy rations and consequent reduced intake of carotene. It is suggested that the higher fat content of the high-energy rations improved the utilisation of carotene. The composition of breast muscle was not affected by the diets except that fat content was reduced by the low-energy ration.—J. S. Thomson. (Nutrition Abstracts & Reviews)

OLSEN, E. M., J. D. HARVEY, D. C HILL, and **H. D. BRANION.**
IN VITRO CONVERSION OF CAROTENE TO VITAMIN A BY CHICK LIVER AND INTESTINE. *Poultry Sci.*, 1959, 38, 950, 956. [Dept. Nutrit., Ontario Agric. Coll., Guelph.]—Liver and duodenum were removed from chicks depleted of vitamin A by feeding for a week on a ration free of carotene and vitamin A. An aqueous suspension containing 2000 μg. carotene in Tween 60 was inserted into the lumen of the duodenum and the tissue was incubated for 6 hr. at 37° C. Samples of homogenised liver, 3 g., in a suspension containing 3000 μg. carotene, were incubated for a similar length of time. More carotene was converted to vitamn A in liver than in duodenum, 26 I.U. per sample compared with 19.6 I.U.; the difference may have been due to the larger amount of carotene added to liver or to more enzyme activity in liver. When carotene, 100, 200 or 600 μg., was added to a liver homogenate and incubated for 6 hr. little was converted to vitamin A, 1 per cent. with the 2 lower levels and 0.3 per cent. with the highest. In experiments with liver homogenates incubated with 20, 60 or 100 μg. carotene for different times from 15 min. to 6 hr., significant amounts were converted to vitamin A within 15 min., but differences were so small than an optimum time could not be stated.—J. S. Thomson. (Nutrition Abstracts & Reviews)

ORMA, E., D. N. RHODES, and **A. KEYS.**
EGG-CONTAINING MEALS AND BLOOD COAGULATION. *Lancet*, 1959, i, 388-390. [Lab. Physiol. Hyg., Univ. Minnesota, Minneapolis.]—Nine physically normal men were given a breakfast of toast and jelly with, in 6 tests on groups of 3 in rotation, additions of 3 whole eggs, 3 egg whites, 3 egg whites with lipids of 3 eggs, total or with phosphatidyl ethanolamine or all phospholipids removed, or a fat-free test meal of sucrose, rice and milk solids which provided 1078 Cal. Samples of blood were taken 1 hr. and immediately before and 3½ and 4½ hr. after the meal. Whole blood coagulation and plasma Stypven times were measured.

For coagulation time no significant change was found after any of the different additions. Stypven time was reduced after all the lipid meals but not after egg white or carbohydrate. Lipids with phospholipids were no more effective than those with only neutral fat.

The findings are discussed in relation to the work of O'Brien (see Absts. 481, Vol. 27 and 798, Vol. 28).—D. Harvey. (Nutrition Abstracts & Reviews)

ORSZAGH V., and J. MICEK. Posobenie Dubosolu na zvysenie prirastkov u kacic.

EFFECT OF DUBOSOL IN INCREASING WEIGHT GAINS IN DUCKS. *Pol'nohospodarstvo*, 1959, 6, 403-418. [Res. Inst. Poultry Breeding, Ivanka pri Dunaji, Czechoslovakia.] German and Russian summaries.—In a trial lasting 8 weeks 2 g. Dubosol (see Abst. 1572, Vol. 28) per kg. feed significantly increased growth rate of ducklings by 17 and of ducks by 9 per cent. Feed intake was greater in groups not given the supplement, and efficiency was significantly less. There was no advantage from combining antibiotics with Dubosol. —M. Proksova (Czechoslovakia). (Nutrition Abstracts & Reviews)

PAINE, C. M., H. J. NEWMAN, and M. W. TAYLOR.

INTESTINAL ABSORPTION OF METHIONINE AND HISTIDINE BY THE CHICKEN. *Amer. J. Physiol.*, 1959, 197, 9-12. [Dept. Agric. Biochem., Rutgers Univ., New Brunswick, N.J.]—Mature chickens were provided with Thiry Vella loops of intestine. Amino acid solutions were continuously passed through the loop, and the rate of uptake was measured. L-Methionine was absorbed at the rate of 15.3 ± 2.5 μmoles per hr., D-methionine at 8.6 ± 1.2, L-histidine at 8.1 ± 2.2 and D-histidine at 3.2 ± 1.1. Absorption of L-methionine was depressed by 2 : 4-dinitrophenol at a concentration of 10^{-3} *M*, and that of L-histidine by the presence in equimolar concentration of L- or *D*-methionine.

A length of the small intestine of pullets aged 6 to 8 weeks was ligated and a solution of D-methionine was injected. After 10 min. a sample of blood was taken from the mesenteric vein and L- and D-methionine were estimated manometrically. No evidence of racemisation was found. Unabsorbed D-methionine from the loop perfusion experiments showed no trace of the L-isomer.—M. M. Barnes. (Nutrition Abstracts & Reviews)

PATZSCHKE, D. Kukenmast bei Verwendung von Aurofac.

USE OF AUROFAC FOR FATTENING CHICKENS. *Jahrb. Arbeitsgemeinschaft Futterungsberatung*, 1957/58, 1, 188-190.—A group of 107 day-old Leghorn chickens was given a control ration and another group of 164 received Aurofac supplying 10 mg. aureomycin per kg. feed. Numbers successfully reared to 10 weeks of age were 88 and 154, the average weights then were 894 and 1064 g. and the average feed eaten per bird was 3450 and 3896 g., respectively. Efficiency of feed utilisation was 10 per cent. better when Aurofac was given. The experimental group was hatched from eggs treated with Ger-Biotol, a vitamin and antibiotic complex, which was claimed to give 11 per cent. better hatching results.—A. Hepburn. (Nutrition Abstracts & Reviews)

PATZSCHKE, D. Legeleistung bei Zusatz verschiedener Eiweissfuttermittel.

EFFECT OF DIFFERENT PROTEIN FEEDINGSTUFFS ON LAYING PERFORMANCE. *Jahrb. Arbeitsgemeinschaft Futterungsberatung*, 1957/58, 1, 204-207.—Groups of 125 White Leghorn laying hens were given a ration of wheat, barley meal, wheat bran, potatoes and skimmed milk alone or with terramycin, 10.56 g. per 1000 kg. dry feed, or with additional skimmed milk 70 g. dailv or fishmeal 5 g. daily. Daily intake of crude protein was for the first 2 groups 13.8 g. and for the others 16.3 g.

In 289 days the mean numbers of eggs laid were 118, 119, 137, 139 in the 4 groups, respectively; crude protein and crude fat required per egg were 33.6 and 5.4 g. in the first 2 groups and 34.4 and 4.9 g. in the others. Total nutrients required to produce 1 kg. egg were 3.31, 3.31, 3.01 and 2.83 kg. in the 4 groups, respectively.—R. G. Hankin. (Nutrition Abstracts & Reviews)

PEPPER, W. F., S. J. SLINGER, H. L. ORR, and E. S. SNYDER.

EFFECT OF HIGH AND LOW ENERGY DIETS AND RANGE *VERSUS* CONFINEMENT REARING ON EGG PRODUCTION AND

QUALITY OF FRESH AND HELD EGGS. *Poultry Sci.*, 1959, 38, 379-385. [Dept. Poultry Husb., Ontario Agric. Coll., Guelph.]—Day-old chicks of different strains and crosses in equal numbers were reared to 12 weeks of age in confinement, one-half of the birds of each strain or cross receiving a high-energy ration and the other half a low-energy ration free choice. From 12 to 20 weeks one-half of the birds were reared on range and the other half in confinement and with each rearing system one-half had low-energy rations and the other half high. During this period feed intake was restricted so that all the birds in confinement got the same amount of energy daily, regardless of the energy content of the ration. The range-reared birds got less energy than the birds reared in confinement, but again the high- and low-energy rations were given on the basis of equivalent energy. For the periods 0 to 4, 5 to 8, 9 to 14 and 15 to 20 weeks the productive energy values of the high-energy rations were 916, 929, 944 and 973 Cal. per lb. and for low-energy rations 872, 874, 877 and 879 Cal. At each age period the ratio of energy to protein percentage was the same for the high- and low-energy ration, 42, 46, 50 and 61. For the high-energy rations the cereal portion was wheat and maize, for the low an increasing amount of oats replaced maize. From 20 weeks, when the birds were transferred to their laying quarters, a high-energy ration was given and egg production was recorded for 280 days.

At the beginning of the laying period body weight was slightly greater with the high-energy rations, but there was no difference at the end of the laying period. Egg production was not affected by the energy content of the ration, nor was feed efficiency. Egg production was slightly higher in the range-reared birds, but the difference was not significant. Bodyweight was slightly higher in the birds reared in confinement, but the range-reared birds had received slightly less feed. Quality of fresh eggs or eggs held for 14 days at 55° F., measured in Haugh units, was unaffected by the energy content of the ration or by the system of feeding.

It is concluded that rations high in oats or maize will give equally good results when the rations are given free choice for the first 12 weeks and restricted to supply equal energy for the rest of the growing period.—J. S. Thomson. (Nutrition Abstracts & Reviews)

PETERS, S. S.

FOOD HABITS OF THE NEWFOUNDLAND WILLOW PTARMIGAN. *J. Wildlife Management*, 1958, 22, 384-394. [Wildlife Div., Dept. Mines Resources, St. John's, Newfoundland.]—The damp contents of over 300 crops and 500 droppings from Newfoundland willow ptarmigans *(Lagopus lagopus alleni)* of the Avalon Peninsula were analysed during 3 years and feeding habits were recorded. The total volume of individual food items was estimated for each locality and season and frequency of occurrence were noted. The birds ate mainly vegetable matter, especially berries and leafy material, but resorted to twigs and buds in winter. Young birds sampled a great variety of feeds. Peak feeding time was in the afternoon. The blueberry *(Vaccinium angustifolium)*, fruit, leaves buds, blossoms and twigs, was the most important source of food. It is extremely abundant but is being superseded in some places by sheep laurel *(Kalmia angustifolia)*, which the ptarmigan avoids. The advantages of a systematic burning programme as a means of preventing further decline of the ptarmigan population are discussed.—I. R. Anderson. (Nutrition Abstracts & Reviews)

PISANO, J. J., C. M. PAINE, and M. W. TAYLOR.

THE EFFECT OF METHIONINE DEFICIENCY ON NITROGEN ABSORPTION FROM THE INTESTINAL TRACT OF CHICKENS. *J. Nutrition*, 1959, 67, 213-222. [Dept. Agric. Biochem., New Jersey Agric. Exp. Stat., Rutgers Univ., New Brunswick.]—Day-old chicks were given a diet low in methionine and consisting mainly of field peas, or that diet supplemented with 0.33 per cent. DL-methionine. At 3 months of age the average weights of birds were, respectively, 480 and 1200 g. the apparent coefficient of absorption of food N in the contents

of different parts of the digestive tract was estimated by the chromic oxide method of Schurch *et al.* (Abst. 3204, Vol. 20). No digestion or absorption took place in the crop. There was a decrease of both N and chromic oxide in the gizzard contents, possibly because of selective movement from the gizzard of fluid containing products of protein breakdown by pepsin from the proventriculus and finely dispersed chromic oxide. Considerable amounts of N, presumably in enzymes, were secreted into the duodenal loop, particularly in the birds given methionine, so that possible absorption was masked. Absorption of N was maximum just below the duodenal loop and continued, at decreasing rates, down to the caecum. The absorption coefficients were higher in chicks lacking methionine; their ability to digest and absorb protein was not impaired, but their feed intake was low.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

POLLARD, C. J., and J. G. BIERI.
STUDIES OF THE BIOLOGICAL FUNCTION OF VITAMIN E. 1. TOCOPHEROL AND REDUCED DIPHOSPHOPYRIDINE NUCLEOTIDE-CYTOCHROME *C* REDUCTASE. *Biochim. biophys. Acta*, 1959, 34, 420-430. [Nat. Inst. Arthritis Metabol. Dis., Nat. Insts. Health, Bethesda, Md.]—1. Heart muscle from chicks deprived of vitamin E or vitamins E and K had the same reduced diphosphopyridine nucleotide cytochrome *c* reductase activity as that from normal chicks, but α-tocopherol was absent. The inactivation of preparations of the enzyme by extraction with *iso*-octane was reversed by lyophilisation, centrifuging and, partly, by adding vitamin E or K_1. Substances other than α-tocopherol which reacted with $FeCl_3$-dipyridyl reagent were found in unsaponifiable extracts of chick and ox tissue.—A. Hepburn. (Nutrition Abstracts & Reviews)

POPESCU, F., V. NEDELNIUC, S. DIMOVICI, and A. TACU. Actiunea cobaltului asupra dezvoltarii puilor, productivitatii si metabolismului bazal la gaini.
EFFECT OF COBALT ON THE DEVELOPMENT OF CHICKENS AND ON PRODUCTIVITY AND BASAL METABOLISM OF HENS. *Lucr. Stiint. Inst. Cercet. Zooteh., Bukarest*, 1958, 16, 545-565. Russian, French, German and English summaries.—Cobalt chloride, 50 to 160 μg. per kg. liveweight, given in the feed 3 times a week to 322 Sussex chickens 4 or 6 days old at the start improved liveweight by 44 per cent. at 30 days and by 16 per cent. at 6 months. Skeletal development and Hb values were improved also, and appetite was better.

Pullets given cobalt chloride started laying 9 days earlier than birds not given the mineral, and total weight of eggs laid was 5 per cent. greater, though weight per egg was less. Fertility of eggs was better and Hb values were higher. Basal metabolism of hens was not affected by 250 μg. cobalt chloride per kg. liveweight 3 times a week. (From English summary.)—T. D. Bell. (Nutrition Abstracts & Reviews)

PRICE, K. E., and Z. ZOLLI (Jr.)
INFLUENCE OF OLEANDOMYCIN AND PENICILLIN ON INTESTINAL TRACT MICROFLORA OF CHICKENS. *Poultry Sci.*, 1959, 38, 873-877. [Chas. Pfizer and Co., Inc., Terre Haute, Ind.]—(Nutrition Abstracts & Reviews)

RANNEY, R. E.
EFFECT OF Δ-4-CHOLESTENONE ON CHOLESTEROL AND PHOSPHOLIPID METABOLISM IN THE CHICK. *Proc. Soc. Exp. Biol. Med.*, 1958, 99, 462-466. [Div. Biol. Res., G. D. Searle and Co., Chicago, Ill.]—Cockerels reared to 4 weeks of age on a commercial chick ration received for 3 days 1.5 per cent. Δ-4-cholestenone in the diet. These birds and controls not treated fasted overnight and then received an intravenous injection of 20 μC. sodium acetate-^{14}C and 200μC. sodium phosphate-^{32}P, 1.48 and 1.45 mg., respectively. After 30, 60 and 240 min. plasma and liver biopsy samples were taken and after the

last sampling the birds were killed. In a second experiment cockerels 5 weeks old received 0.1 per cent. Δ-4-cholestenone in the diet for 12 days and were injected with 20 μC acetate-^{14}C and then treated as in the first experiment.

Cholestenone in both tests caused a slight, not significant, fall of plasma cholesterol and did not affect liver cholesterol. The aorta contained significantly less cholesterol after cholestenone in both experiments. Plasma phospolipids, but not those of liver or aorta, were significantly reduced. Cholestenone significantly increased the amount of acetate incorporated into liver cholesterol. The labeling of plasma cholesterol was significantly increased after 240 min., not earlier. The specific activity of aorta cholesterol was greatly reduced. More ^{32}P was incorporated into phospholipids of liver and plasma, but the effect in the aorta was slight. Results are contrasted with those reported by Steinberg and Fredrickson *(Ann. N.Y. Acad. Sci.,* 1956, 64, 579) in rats, in which cholestenone reduced plasma cholesterol and incorporation of acetate into liver lipids.—D. Duncan. (Nutrition Abstracts & Reviews)

RAO, B. S. N., and V. N. PATWARDHAN.

NUTRITIVE VALUE OF DUCK EGG WHITE. 6. FURTHER OBSERVATIONS ON THE GROWTH RETARDING PROPERTY OF DEW OVOMUCOID. *Indian J. Med. Res.,* 1958, 46, 828-834. [Nutrit. Res. Labs., Indian Counc. Med. Res., Coonoor.] For part 5 see Abst. 198, Vol. 29.—6. In 4 weeks, the average weight gain of 6 rats on a diet with 10 per cent. casein and 1 per cent. purified duck egg white ovomucoid was 39.7 g. compared with 60.3 g. without the ovomucoid. Growth as not retarded when rats received daily intraperitoneal injections of 50 mg. purified ovomucoid for 28 days, showing that the ovomucoid had no systemic effect.

Raising the level of protein in the diet counter-balanced the depression of growth. Thus, after 4 weeks with 1 per cent. ovomucoid the average weight gains of rats on diets with 5, 10 and 20 per cent. protein were 9.5, 31.7 and 58.3 g., respectively, compared with 33, 54.9 and 66.6 g. without ovomucoid. Doubling the mineral and vitamin contents of a diet with 75 per cent. sucrose did not influence the inhibition of growth. The absorption of N from casein hydrolysate supplemented with 1 per cent. ovomucoid was only slightly less than without ovomucoid, and the difference might have been due to excretion of undigested ovomucoid in the feces. No inhibition of growth was found when purified hen egg white ovomucoid supplemented the diet.—S. Weir. (Nutrition Abstracts & Reviews)

RIGDON, R. H., T. M. FERGUSON, V. S. MOHAN, and J. R. COUCH.

IN VIVO PRODUCTION OF A CEROID-LIKE PIGMENT IN CHICKENS GIVEN GOSSYPOL. *Arch. Pathol.,* 1959, 67, 94-101. [Dept. Pathol., Univ. Texas Med. Branch, Galveston.]—Chicks were given a synthetic diet containing 0.4 per cent. gossypol in the form of pigment glands from cottonseed, or injections of gossypol as a Tween-saline preparation. With gossypol in the diet a ceroid-like pigment appeared in the liver and less in the spleen. Its amount slowly decreased, and little was present 24 days after feeding on gossypol was discontinued. The pigment was widely distributed throughout the liver, but was concentrated round the portal vessels. Chicks injected intravenously showed little pigment in liver and spleen, but some birds died within 25 min., after injection. Extensive necrosis occurred in the pectoral muscle after local injection, accompanied by a yellowish-brown pigment, which was phagocytised locally by macrophages. It is suggested that the lethal effects of gossypol may be due to its action on vital structures such as cardiac muscle. E. M. Cruickshank. (Nutrition Abstracts & Reviews)

ROY, R. N., and B. C. GUHA.

PRODUCTION OF EXPERIMENTAL SCURVY IN A BIRD SPECIES. *Nature,* 1958, 182, 1689-1690. [Dept. Appl. Chem., Univ.

Coll. Sci. Technol., Calcutta 9.]—When 6 red-vented bullbuls *(Pycnonotus cafer)* received a scorbutogenic diet they lost weight and feathers and died after between 16 and 45 days; autopsy showed haemorrhage, subcutaneous, inside joints and in the liver. Three deprived birds which received ascorbic acid recovered. The bank-myna *(Acridotheres ginginianus)* which was shown by the cyanide technique (see Abst. 459, Vol. 29) to be capable of synthesising ascorbic acid, remained healthy, 2 birds, after 72 days on the diet.—A Hepburn. (Nutrition Abstracts & Reviews)

RUBIO PAREDES, J., and T. PEREZ GARCIA.
VITAMIN A AS A FACTOR AFFECTING FERTILITY IN COCKERELS. *Poultry Sci.*, 1959, 38, 3-7. [Patronato Biol. Animal, Madrid.]—The basal ration used with 10-month-old cockerels was deficient in vitamin A, 0.16 I.U. per g. For the control group the ration was supplemented with 1,000,000 I.U. vitamin A palmitate per 100 kg. feed to give a content of 8 I.U. per g. The experimental group continued on the basal ration. The experiment ran for 10 weeks and was followed by a 2-week recovery period when both groups had in addition 30,000 I.U. per kg. ration.

To the end of the fourth week there was no difference between groups in appearance of semen, volume of ejaculate, sperm motility, sperm count or number of abnormal forms. From the fifth week semen in the experimental group deteriorated in appearance, becoming greyish white and watery, volume of ejaculate was unchanged, motility of sperms fell from 5/5 to 1/5 (Bonadonna scale), and sperm count fell from about 2.75 million to an average of 290,000 per c.mm. while the number of abnormal forms rose from 18 to 33 per cent. When the feed was supplemented with 30,000 I.U. vitamin A per kg. the quality of semen of the experimental birds returned to normal in about 2 weeks.—J. S. Thomson. (Nutrition Abstracts & Rev.ews)

SCHJEIDE, O. A., and M. R. URIST.
NUTRITIONAL ASPECTS OF EGG YOLK. *Nutrition Rev.*, 1959, 17, 1-3. [Metabol. Radiobiol. Sect., Dept. Nuclear Med. Radiation Biol., Univ. California, Los Angeles.] (Nutrition Abstracts & Reviews)

SCHULTZ, V.
VITAMIN A AND OHIO BOBWHITE QUAIL DURING THE WINTER OF 1947-48. *J. Wildlife Management*, 1959, 23, 322-327. [Agric. Exp. Stat., Univ. Maryland, College Park.]—To establish the part played by vitamin A in the survival of bobwhite quail *(Colinus virginianus)*, especially in severe weather, 128 quail were collected during 2 successive winters from 2 counties of Ohio differentiated by presence or absence of glaciation. Bodyweights showed that all were in good physical condition. Vitamin A, expressed in I.U. per g. liver or per whole liver, was adequate in all but range of individual values was great. There was no significant difference in liver storage between the sexes, counties or years of investigation, although one winter was colder than the other.—I. R. Anderson. (Nutrition Abstracts & Reviews)

SENIOR, B. J., and E. J. SHEEHY.
THE FEEDING OF ANTIBIOTICS TO CHICKS AND PIGS. *J. Dept. Agric., Republic of Ireland*, 1957-58, 54, 5-43. [Animal Nutrit. Dept., University Coll., Dublin.]—In feeding trials with mixed White Wyandotte and Rhode Island Red chickens, procaine penicillin, 6.3, 12.5 or 25.0 g. per ton meal, increased growth, particularly between 8 and 10 weeks. Similar results were obtained by adding Aurofac or Aurofac A equivalent to 1 g. aureomycin per ton meal. On a diet containing only vegetable protein, Aurofac or Aurofac A improved growth more than penicillin. Subsequent trials in which vitamin B_{12} plus penicillin was added to a vegetable-protein diet indicated that the vitamin B_{12} content of Aurofac may favourably affect growth.

Adding 10 g. procaine penicillin per ton feed to a normal ration

for Large White weaned pigs gave a significant increase of liveweight in one trial out of 4. In 2 trials with aureomycin, 18 g. per ton, there was no significant effect on growth rate. Where high-energy rations were used, both penicillin and aureomycin increased growth rate, but not to that with normal rations. No significant effect of penicillin or aureomycin supplementation was seen in runt pigs.—M. E. Falconer. (Nutrition Abstracts & Reviews)

SEVKOVIC, N., and S. PRIBICEVIC. Znacaj vitaminskog prihranjivanja u odgajivanju pilica i prasadi.

IMPORTANCE OF VITAMIN SUPPLEMENTATION IN REARING CHICKENS AND PIGS. *Vet. Glasnik*, 1959, 13, 263-267, English summary.—In the first 20 days from hatching chickens received a standard ration of, per cent., maize 48, bran 10, wheat germ 12, groundnut cake 5, sunflower seed cake 3, soya bean cake 5, lucerne meal 5, fishmeal 3.5, meatmeal 5, bloodmeal 1.4, dried yeast 0.1, Kostan 1 and musselshell meal 1. From 20 days they were divided into 6 groups of 18 or 19 birds and given rations with 20 per cent. protein, either all of plant origin or with 2 or 4 per cent. animal protein; on each type of ration one group had no supplement and the other had extra vitamins A and D_3 in the form of 0.15 per cent. Dohyfral (Philips Roxane). The birds given the vitamin supplement quickly outstripped the others. With the vitamin supplement 2 per cent. animal protein was not better than none, but 4 per cent. gave the greatest growth and most efficient feed utilisation of any group. When the extra vitamins were not given, animal protein gave some benefit.

Three groups of 20 weanling pigs were fed on a ration of, per cent., bran 5, barley 45, oilcake 10, peas 10, maize 10 and oats 20, with minerals, alone or with 0.1 per cent. Dohyfral, or were given on 3 occasions at intervals of 2 weeks Dohyfral in oil. Towards the end of the study green lucerne was given. Final weight gains were little improved by the vitamin supplement, but before the lucerne was introduced the supplement given in the ration had some value.—D. Duncan. (Nutrition Abstracts & Reviews)

SIEBURTH, J. M.

GASTROINTESTINAL MICROFLORA OF ANTARCTIC BIRDS. *J. Bacteriol.*, 1959, 77, 521-531. [Animal Pathol. Sect., Virginia Polytech. Inst., Blacksburg.]—Twenty-eight birds, including predators or scavengers and marine feeders, were investigated for total intestinal flora count, total aerobes, coliforms, enterococci and anaerobes. The gulls had a facultatively anaerobic flora, mainly coliform types, and the penguins had a mainly anaerobic flora. Some streptococci were found, but not enterococci or lactobacilli. Antibacterial effects of gastrointestinal contents against test organisms were traced to the blood serum in the predators, and in the penguins to phytoplankton from the stomachs of what appeared to be the birds' principal food, lobster krill. The presence of the phytoplankton in sea water was thought to be the reason for small populations of marine planktonic bacteria.—E. Hobson. (Nutrition Abstracts & Reviews)

SHERMAN, W. C., G. A. DONOVAN, W. M. REYNOLDS, and H. G. LUTHER.

STUDIES OF NUTRITIONAL LEVELS OF OLEANDOMYCIN IN BROILER RATIONS. *Poultry Sci.*, 1959, 38, 869-873. [Agric. Res. Centre, Chas. Pfizer and Co., Inc., Terre Haute, Ind.]—Oleandomycin was tested with chickens in circumstances where penicillin no longer gave a significant effect on growth.

In 3 experiments chickens were reared in batteries to 4 weeks of age on starting rations alone or supplemented with oleandomycin, from 0.5 to 25 g., or procaine penicillin, 4 or 5 g. per ton. Penicillin produced only a slight growth response, but oleandomycin produced a significant response in each trial and 1 g. was as good as higher levels; with a combination of 4 g. penicillin and 1 g. oleandomycin growth was no

better than with oleandomycin alone. Efficiency of feed conversion was not affected by any of the supplements. With broilers reared to 9 weeks oleandomycin, 2 or 8 g., gave a significantly greater response than penicillin, and a combination of the antibiotics had no additional effect.

In further experiment with broilers reared to 10 weeks procaine penicillin, 10 g. per ton, was given continuously and oleandomycin 0.5, 1.0 or 10 g. was given continuously or for the first 5 weeks or last 5 weeks only. Penicillin improved growth rate and feed efficiency only slightly. At 5 weeks of age oleandomycin produced the heaviest birds, significantly so at the highest level. When oleandomycin was given only during the starting or finishing periods, heavier birds were produced at 10 weeks, but at each level the response was greatest with continuous feeding.—J. S. Thomson. (Nutrition Abstracts & Reviews)

SIBBALD, I. R., and L. M. HUTCHESON.

THE CONVERSION OF β-CAROTENE TO VITAMIN A IN THE LIGATURED DUODENUM OF THE CHICK. *Poultry Sci.*, 1959, 38, 701-706. [Dept. Nutrit., Ontario Agric. Coll., Guelph.]—A series of 4 experiments has shown that when the blood supply of the organ is unimpaired β-carotene is absorbed and converted into vitamin A by the wall of the duodenum proximal to the entry of the common bile duct. The presence of bile or of pancreatic juice is unnecessary.

It is not known why the mechanism fails in the absence of a blood supply, *in vivo* and *in vitro*, but it is postulated, without evidence, that failure of the duodenal wall to absorb carotene may be the cause.

No conversion of β-carotene to vitamin A took place in the lumen of the duodenum, and continuity of the gut lumen was not necessary for the conversion.—J. G. Gordon. (Nutrition Abstracts & Reviews)

SIBBALD, I. R., and L. M. HUTCHESON.

THE INABILITY OF THE CROP TO CONVERT β-CAROTENE TO VITAMIN A WITHIN FOUR HOURS. *Poultry Sci.*, 1959, 38, 698-700. [Dept. Nutrit., Ontario Agric. Coll., Guelph.]—Under Nembutal anaesthesia the crops of eight 4-week-old, vitamin-A-deficient male chicks were exposed and tied at the neck end. In 4 of them, controls, an injection into the crop was made of 1 ml. of 2 per cent. Tween 80 in water and in the other 4, 1 ml. of a β-carotene solution in Tween 80, containing 25.5 μg. β-carotene, was injected; the crops were replaced and the birds were killed 4 hr. later and β-carotene and vitamin A were estimated in the crop content and crop wall.

No vitamin A or carotene was found in crop content or crop wall of the controls, and β-carotene was found in the crop wall of only one of the birds receiving β-carotene, and then only to the extent of 2 μg. An average of 25.6 μg. β-carotene was recovered from the crop contents of the birds injected with β-carotene, showing no conversion to vitamin A.

In a further similar experiment bile or pancreatin or both were injected with β-carotene. Absorption of β-carotene by the crop wall was negligible except when bile was added, which suggested that bile may play a part in converting β-carotene to vitamin A in the wall of the alimentary tract. Vitamin A was found in the crop wall of only one bird. Recovery of β-carotene from the crop wall and contents was poor except when pancreatin was added, and it is concluded that β-carotene was degraded during the time it remained in the crop.—J. S. Thomson. (Nutrition Abstracts & Reviews)

SKURATOV, I. S. Kormovoj ljupin-vaznyj istocnik belka dlja pticy.

FODDER LUPIN, AN IMPORTANT SOURCE OF PROTEIN FOR POULTRY. *Pticevodstvo*, 1959, No. 3, 17-18. (Nutrition Abstracts & Reviews)

SKURATOV, I. S. Skarmlivanie ptice silosovannoj kukuruzy.

FEEDING POULTRY ON ENSILED MAIZE. *Pticevodstvo*, 1959, No. 4, 13-16. [Ukrain. Opyt. Stancija Ptice.] (Nutrition Abstracts & Reviews)

SNOOK, L. C.

THE USE OF ROCK PHOSPHATE FROM CHRISTMAS ISLAND IN POULTRY RATIONS. *J. Agric. W. Austral.*, 1958, 7, 545-550. [Animal Health Nutrit. Lab., Smyth Rd., Nedlands.] — Christmas Island rock phosphate substituted for bone flour in the growing and laying mashes of Australorp pullets 6 weeks old at the start did not affect growth or egg production. The laying mash with bone flour had 30 p.p.m. F and that with rock phosphate 444 p.p.m. There was no great increase of F content of the egg pulp, but the eggshell and bones contained more when the rock phosphate was given.—M. E. Falconer. (Nutrition Abstracts & Reviews)

STAMLER, J., R. PICK, and L. N. KATZ. (with D. CENTURY, and P. JOHNSON.)

EFFECTS OF DIETARY PROTEINS, METHIONINE AND VITAMINS ON PLASMA LIPIDS AND ATHEROGENESIS IN CHOLESTEROL-FED COCKERELS. *Circulation Res.*, 1958, 6, 442-446. [Med. Res. Inst., Michael Reese Hosp., Chicago, Ill.] Interlingua summary.—Eighteen groups of 10 cockerels, 8 to 16 weeks old, were given for 5 to 10 weeks rations with a commercial chick starter mash or purified ingredients as base and containing 20, 35 or 63 per cent. protein. From 0.5 to 2 per cent. cholesterol and 5 per cent. cottonseed oil were added to all rations, *dl*-methionine to most and extra vitamins to some.

Compared with the control groups given cholesterol, cottonseed oil, *dl*-methionine and 35 per cent. protein, the lower protein level gave lower feed intake and weight gains and more lesions in thoracic aortae; otherwise there was no difference in atherogenesis, or in plasma lipids. Diets with restricted intake of methionine increased cholesterol values in blood, cholesterol : phospholipid ratio and coronary and aortic atherosclerosis. There was no difference in feed intake or weight gains. A high-protein purified ration with added vitamins reduced feed intake and weight gains; there was less blood cholesterol and no coronary lesion in 2 of 3 trials, and atheroma of the thoracic aorta was found in one bird only. A high-protein mash ration with added vitamins reduced feed intake slightly, but weight gains were greater, there was less cholesterol in blood and incidence of atheroma was lower. A mash ration high in protein or with extra vitamins reduced feed intake and weight gains, and blood cholesterol was as high as or higher than in the controls; the high-protein mash reduced coronary atherogenesis, but extra vitamins alone had no effect. In trials with purified rations feed intake and weight gains were greater and blood cholesterol and aortic and coronary atherogenesis somewhat less with soya bean protein than with casein and gelatin.

Mash rations gave more blood cholesterol and atherogenesis than purified rations, even when intake of cholesterol was twice as great in the purified ration.

It is suggested in discussion that high protein is decisive and that high vitamin intake has an adjuvant, synergistic effect.—R. G. Hankin. (Nutrition Abstracts & Reviews)

STAMLER, J., R. PICK, and L. N. KATZ (with D. CENTURY and P. JOHNSON.

EFFECTS OF DIETARY PROTEIN AND CARBOHYDRATE LEVEL ON CHOLESTEROLEMIA AND ATHEROGENESIS IN COCKERELS ON A HIGH-FAT, HIGH-CHOLESTEROL MASH. *Circulation Res.*, 1958, 6, 447-451. [Med. Res. Inst., Michael Reese Hosp., Chicago, Ill.] Interlingua summary.—Cockerels 9 weeks old were given for 5 weeks a commercial chick starter mash containing cholesterol 1 and cottonseed oil 5 per cent., supplying 20 per cent. protein. Two trial groups were given the same ration with sucrose 45 or 20 per cent. and supplying 10 or 15 per cent. protein, and 2 further groups were given the 2 levels of sucrose with supplements of soya bean protein to restore the protein content to 20 per cent.

The reduced protein intake with sucrose gave much higher blood

cholesterol and more aortic and coronary atherogenesis, which were prevented when protein intake was restored by supplements of soya protein.

It is suggested from these results and those of previous work (see preceding Abst.) that excess fat and cholesterol combined with inadequate protein may be of primary importance in the production of high blood cholesterol and atherosclerosis, and that this dietary combination is prevalent among some Americans with low income. Further work on man is required to test the hypothesis.—R. G. Hankin. (Nutrition Abstracts & Reviews)

STANHOPE, W.

ECONOMY OF FEEDING WHEAT AND MEAT MEAL TO POULTRY. *J. Agric., Victoria*, 1958, 56, 729-730.—In a field trial with 2 groups of 152 hens one group got a pelleted ration; the other was allowed wheat to appetite and meatmeal was given separately, mixed with some green feed. Both groups had the same green feed. In 5 months egg yield on wheat and meatmeal, and on pellets, respectively, was 61 and 70 per cent., and feed per 12 eggs was 5.0 and 5.9 lb. The wheat and meatmeal was the more profitable.—T. D. Bell. (Nutrition Abstracts & Reviews)

STEINEGGER, P., and G. ZANETTI. Versuche zur Ermittlung der Einflusse verschiedener Carotinoidzusatze zum Leghennenfutter auf die Dotterfarbe.

EFFECTS OF DIFFERENT CAROTENOIDS ADDED TO THE DIET OF LAYING HENS ON YOLK COLOUR. *Arch. Geflugelk.*, 1959, 23, 166-173. [Schweiz. Lehranst. Geflugelzucht, Zollikofen, Berne.] English summary. For previous work see Abst. 327, Vol. 28.—White Leghorn hens were transferred from a diet rich in carotenoids to one of natural feedingstuffs poor in carotenoids, with added vitamins A and D_3 and riboflavin. There were 8 groups of 20; each of 6 groups received a different carotene derivative. The experiment lasted 84 days in which different forms of the carotene derivatives were given, generally as 0.3 mg. daily, dissolved in arachis oil and incorporated in a portion of the feed which was given to each bird first. In the last period, 2 only of the derivatives were tested in daily doses of 0.1, 0.3 and 0.6 mg. One group had arachis oil only, and one had a normal diet. A standard colour scale was established for the egg yolk.

The yolk colour of the normally fed group was maintained throughout. That of the group without carotenoids faded gradually, and the yolk became colourless within from 3 to 4 weeks. With β-apo-10′-carotenal (C_{27}) the yolks lost all colour; the bleaching was less complete with β-apo-6′-carotenal (C_{25}), and with β-apo-4′-carotenal (C_{23}) the yolks had a strong red colur. The same red colour was given by 0.6 mg. daily of β-apo-8′-carotenoic acid (C_{30}) methyl ester, but 0.3 mg. daily of the same substance or 0.6 mg. daily of β-apo-8′-carotenal (C_{30}) gave a deep natural colour, like that obtained with grassmeal.

The yolk colour did not deteriorate after storage for 3 months at from 12° to 16° C. The colouring of the birds' beaks and legs was not affected.—E. M. Hume. (Nutrition Abstracts & Reviews)

STEWART, I. J.

GROWING PULLETS INTENDED FOR LAYERS. PROTEIN REQUIREMENTS. *J. Agric., Victoria*, 1959, 57, 227-231. [State Res. Farm, Werribee.]—Three years of experiments with first-cross pullets have shown that 13 per cent. protein in the diet was sufficient from 6 weeks of age until point-of-lay. More protein did not advance the date of laying, but increased amount of feed eaten, decreased efficiency of feed utilisation and did not affect egg production in the laying period, or mortality. From hatching until 6 weeks of age, 16 per cent. protein in the diet gave variable growth compared with 20 per cent., but performance after 6 weeks was unaffected.—J. G. Gordon. (Nutrition Abstracts & Reviews)

STRIZIC, M. Metoda potenciranja djelovanja antibiotika (predhodno saopcenje.)

INCREASING THE ACTIVITY OF ANTIBIOTICS (PRELIMINARY COMMUNICATION. *Stocarstvo*, 1958, 12, 529-537. [Istraziv. Stan. Ishranu Stoke, Zagreb, Podsused.] English summary.—New Hampshire chickens were studied from hatching to about 7 weeks of age, in groups of 30. The basal ration contained 18.71 per cent crude protein of plant origin and 7.96 per cent. crude fibre; for different groups it was given alone or with from 1 to 5 per cent. sunflower seed husks as extra fibre and without or with feed supplements containing terramycin (Pfizer's Antibiotic Feed Supplement). In a second experiment some groups received extra fibre from 20 days of age.

With weight gain to 50 days of age on the basal ration, without antibiotic as criterion, antibiotic alone, increased gain by 13 per cent., antibiotic and 2 per cent. extra fibre by 25, antibiotc and 4 per cent. extra fibre by 44 and antibiotic and 5 per cent. fibre by 25 per cent. With the basal ration plus antibiotic as criterion, growth was improved with 2 per cent. extra fibre by 10, with 4 per cent. by 27 and with 5 per cent. by 10 per cent. Feed efficiency also was improved by the combination of extra fibre and antibiotic and was greatest with antibiotic and 4 per cent. extra fibre, when 39 per cent. less feed was required per kg. weight gain than on the basal ration and 33 per cent. less than with antibiotic alone.

Post-mortem examination of some of the chickens showed that some had signs of vitamin A deficiency, enteritis or rickets, but there was no relation of extra fibre or antibiotic to the incidence of these disorders.—D. Duncan. (Nutrition Abstracts & Reviews)

SUMMERS, J. D., W. F. PEPPER, and **S. J. SLINGER.**

SOURCES OF UNIDENTIFIED FACTORS FOR PRACTICAL POULTRY DIETS. 1. THE VALUE OF FISH MEALS, MEAT MEALS AND FISH SOLUBLES FOR CHICKS AND BROILERS. 2. THE VALUE OF FISH SOLUBLES, DRIED WHEY, DRIED DISTILLERS' SOLUBLES AND CERTAIN FERMENTATION PRODUCTS FOR CHICK AND BROILER DIETS. 3. THE VALUE OF FISH SOLUBLES, DRIED WHEY AND CERTAIN FERMENTATION PRODUCTS FOR TURKEYS. *Poultry Sci.*, 1959, 38, 816-825; 846-854; 922-928. [Dept. Poultry Husb., Ontario Agric. Coll., Guelph.]—1. In all experiments the basal rations of chicks were of the soya bean oilmeal and cereal type, the cereal being maize or mixtures of maize and wheat, and all contained whey factor as 2.5 per cent. dried whey or dried buttermilk. In each experiment the levels of protein, energy, Ca, P, vitamin B_{12} and methionine were constant.

From 2 to 6 per cent. of different samples of fishmeal or from 2.5 to 7.5 per cent. of different meatmeals added to a basal ration had no significant effect on either growth or efficiency of feed utilisation. From 6 to 30 mg. vitamin B_{12} per ton (2000 lb.) added to a basal ration already containing 0.55 mg. significantly increased growth at the lowest level of supplement but had no further effect at the higher levels, from which it is concluded that, with the type of ration used, the vitamin B_{12} requirement of chickens is from 0.00327 to 0.00627 mg. per lb. ration. The lack of response to fishmeal and meatmeal could not be attributed to lack of vitamin B_{12}, since rations containing these had more than 0.008 mg. per lb. Four per cent. fish solubles added to a basal ration gave a significant growth response which was not further increased by adding vitamin B_{12}. Fishmeal or fish solubles added to a ration containing equal amounts of wheat and maize did not significantly improve growth or feed efficiency, nor did fishmeal added to an all-maize ration; the fish solubles significantly increased growth on an all-maize ration, but did not affect efficiency or feed utilisation. Growth was always better with the mixed grains than with maize alone, which suggested that wheat contains a "fish factor", but this was disproved in experiments which showed that the effect of fish solubles was independent of the level of wheat and maize in the ration.

The better growth obtained with wheat also suggested that the maize grown in Ontario had a lower productive energy value than that grown in the United States. Rations containing maize from these sources produced similar rates of gain, each significantly improved when wheat replaced part of the maize or when fish solubles were added. It is suggested that wheat grown in Ontario has a higher energy value than has been reported.

2. The substances tested were fish solubles; dried whey; the fermentation products Vigofac and Neovite; Solulac, a product containing maize distiller's solubles 70 and maize distiller's dried solubles; and Mazoferm, maize fermentation solubles. Practical control all-vegetable protein rations were used in all experiments and level of nutrients in each experiment was kept constant as before.

Fish solubles, 2.5 per cent., added to an all-vegetable protein ration gave slightly better growth in chickens than 2.5 per cent. dried whey, and both together were no better than with fish solubles alone, indicating that dried whey contains no unidentified factor which is not supplied by fish solubles. Vigofac, 0.5 per cent., could completely replace fish solubles, dried whey or a mixture of these. Solulac, 2.5 per cent., and Neovite, 1 per cent., were less effective for growth than fish solubles, dried whey or Vigofac. Mazoferm, 3 per cent., stimulated growth, but not in presence of either penicillin or bacitracin. Penicillin alone had no effect on growth, but bacitracin alone improved it slightly. With broiler rations containing small amounts of fishmeal, meatmeal and dried buttermilk, 2.5 per cent. Stimulflav appeared to depress growth slightly, suggesting that the ration already contained sufficient unidentified factors.

In one experiment in which the cost of the supplements was taken into account it was found that the most economical gains were made with the unsupplemented rations.

3. The fermentation products tested were Vigofac and Neovite together with streptomycin mycelial meal, and in each experiment level of nutrients in the rations was constant.

To a fortified all-vegetable protein basal ration, containing 10 per cent. wheat and 25 per cent. maize, was added dried whey 2.5, or fish solubles 2.5 or Vigofac 0.15 or 0.3 or Neovite 1 or mycelial meal 1 per cent., or mixtures of these. Growth of turkey poults to 4 weeks of age and efficiency of feed utilisation were significantly improved only by fish solubles combined with dried whey or mycelial meal.

On rations with maize only, wheat only or an equal mixture of these, growth was best on the all-wheat ration and least on the all-maize. Dried whey and fish solubles added to each ration improved growth rate, least with the all-wheat ration. Feed efficiency was better with wheat than with maize, and was not further affected by adding the unidentified factors.

Since the experiment just described had shown improvement of growth when dried whey combined with fish solubles was added for a short period of 4 weeks, an experiment was made for an extended period of 24 weeks to determine whether addition of unidentified factors was economically worth while. Vigofac was included also. In the experiment none of the supplements had improved growth or feed efficiency at 4, 8 or 24 weeks of age.

It is suggested that wheat may contain unidentified growth factors similar to or differing from those in dried whey and fish solubles, and that the variable response to dried whey and fish solubles may be due to a carry-over effect from dam to chick.—J. S. Thomson. (Nutrition Abstracts & Reviews)

SUMMERS, J. D., S. J. SLINGER, W. F. PEPPER, I. MOTZOK, and G. C. ASHTON.

AVAILABILITY OF PHOSPHORUS IN SOFT PHOSPHATE AND PHOSPHORIC ACID AND THE EFFECT OF ACIDULATION OF SOFT PHOSPHATE. *Poultry Sci.*, 1959, 38, 1168-1179. [Dept.

Poultry Husb., Ontario Agric. Coll., Guelph.]—Availability of P in the substances tested was estimated from growth rate of chickens to 4 weeks and from estimation of bone ash. In estimating the amounts of P from the different P compounds to be added to the ration to give equivalent amounts of available P it was assumed that the P in dicalcium phosphate was 100, that in soft phosphate 40, and that in H_3PO_4 120 per cent. available. The rations were kept constant in protein, energy and Ca.

On the assumption of 100 per cent. availability of the P in dicalcium phosphate it was found that, in 4 experiments, the availability of P in soft phosphate was 47.5, 48.0, 50.3 and 47.0 per cent. as estimated from bone ash, and 33.4, 40.8, 46.9 and 46.4 per cent. estimated from growth. The lower availabilities from the growth data in the first 3 experiments are attributed to a lower energy content of the soft phosphate ration than of the dicalcium phosphate ration. When this was rectified in the fourth experiment availability was similar by both criteria, indicating that growth rate may be as accurate in estimating availability of P as bone ash estimation. In one experiment with commerical H_3PO_4 availability of P was 131.5 per cent. from growth and 125.4 per cent. from bone ash. A mixture of soft phosphate and H_3PO_4 improved the availability of P in soft phosphate and this mixture may prove of practical importance. Acidulation of soft phosphate with HCl also increased the availability of P but the product was wet and sticky and therefore unsuitable for practical use.—J. S. Thomson (Nutrition Abstracts & Reviews)

SUNDE, M. L., and H. R. BIRD.

THE PROTEIN REQUIREMENTS OF GROWING PULLETS. *Poultry Sci.*, 1959, 38, 48-55. [Dept. Poultry Husb., Coll. Agric., Univ. Wisconsin, Madison.]—For periods of 20 weeks in each of 2 years, 6 groups of day-old chicks were started on a ration with 20 per cent. protein and every 2 weeks one of the groups was transferred to a ration with 15 per cent. protein, so that after 8 weeks only 2 groups were getting 20 per cent. and they were maintained on this ration for the rest of the period. A seventh group received the ration with 15 per cent. protein for the whole period. Cockerels were removed at 4 weeks and at 20 weeks the pullets, except the heaviest and lightest in each group, were given a laying ration with 20 per cent. protein and egg production and hatchability were recorded.

When the ration with 15 per cent. protein was given during the first 4 weeks, rate of gain was reduced by 50 to 75 g., and the effect was still apparent at 12 weeks. All groups given the low-protein ration before 8 weeks of age were lighter at 12 weeks than the controls on high protein. At 20 weeks the birds on the low-protein ration for the entire period were lighter than the other groups in one year but heavier in the second. Mortality in the low-protein group, apart from an outbreak of blackhead, was normal. In both years feeding efficiency to 6 weeks of age was better with high protein, but from 6 to 20 weeks the reverse was found. In both years birds on the low-protein ration for the longest time were the least costly. After 28 weeks the rations given during the growing period showed no effect on bodyweight. Results for egg production were not consistent in the 2 years, and there was no consistent trend in egg weight or hatchability.

Further similar experiments were made with rations of lower protein content. Groups of pullets were reared to 10 weeks on the ration with 20 per cent. protein. From 10 to 20 weeks one group remained on this ration, one group was given a ration with 11 to 12 per cent. protein and other groups had rations of intermediate protein content, sometimes reduced at 15 weeks. Growth at near maximum rate was obtained when a ration with 13 to 14 per cent. protein was given for the entire period, and satisfactory growth was obtained with 11 to 12 per cent. protein. There was no significant trend in feeding efficiency. Subsequent egg production was not affected by the protein content of the growing ration, nor was bodyweight, egg size or hatchability.

It is concluded that with a ration supplying 800 Cal. per lb. 20 per cent. protein is required during the first 6 weeks and after that 15 per cent. protein permits normal growth. From the 15th to the 20th week 12 per cent. protein in the ration will give the best results.—J. S. Thomson. (Nutrition Abstracts & Reviews)

SUPPLEE W. C. and G. F. COMBS.

STUDIES OF THE POTASSIUM REQUIREMENT OF TURKEY POULTS FED PURIFIED DIETS. *Poultry Sci.*, 1959, 38, 833-835. [Dept. Foultry Husb., Univ. Maryland, College Park.]—Previous work (see Abst. 6307; p. 1345, Vol. 28) had shown that the potassium requirement of turkeys on a purified ration based on washed soya bean protein and Cerelose was at lease 0.5 per cent.

In the present experiment the rations were of washed soya bean protein and sucrose or of casein, gelatine and Cerelose containing negligible amounts of K, and from 0.2 to 0.7 per cent. K was added as K_2HPO_4. With the soya protein ration growth response increased as the level of K rose to 0.6 per cent.; increasing the NaCl content from 0.6 to 0.9 per cent. at each level of K had no additional effect. With the casein and gelatine ration the K requirement was at least as high as with the soya protein ration.—J. S. Thomson. (Nutrition Abstracts & Reviews)

SWART, L. G.

IS GREEN FEED ESSENTIAL FOR LAYING HENS? *Farming in S. Africa*, 1959, 35, No. 1, 42-43. [Stellenbosch-Elsenburg Coll. Agric.]—

Egg production, bodyweight change and efficiency of conversion were unaffected by adding green lucerne to an adequate diet containing dried lucerne meal but no fresh green feed.—J. G. Gordon (Nutrition Abstracts & Reviews)

TASAKI, I., and K. KIBE.

A STUDY ON THE DIGESTION OF CELLULOSE IN POULTRY. *Poultry Sci.*, 1959, 38, 376-379. [Lab. Animal Nutrit., Nagoya Univ., Japan.]—Digestibility of cellulose fractions was estimated with 3 pullets on a fibre-free ration and with 6 on the same ration to which 10 g. cellulose powder was added. The cellulose powder contained moisture 8.5 and crude cellulose 91.5: α-cellulose 84.0, β-cellulose 4.8 and γ-cellulose 2.7 per cent. A very small amount of cellulose was found in the excreta of the control birds. In the experimental birds digestibility of crude cellulose was only about 0.6 per cent. About 17 per cent. of the α-cellulose was found to have been converted to the β-form but was not absorbed. Most of the γ-form ingested was excreted.—J. S. Thomson. (Nutrition Abstracts & Reviews)

TEEKELL, R. A., and A. B. WATTS.

TUNGSTEN SUPPLEMENTATION OF BREEDER HENS. *Poultry Sci.*, 1959, 38, 791-794. [Louisiana State Univ., Baton Rouge.]—Addition of 500 p.p.m. sodium tungstate, a reported molybdenum antagonist, to the ration of breeding hens reduced xanthine dehydrogenase of liver, kidney and intestine to negligible amounts within 30 days; 250 p.p.m. had no effect. There was no effect on egg production or hatchability. Day-old chicks from hens on the supplemented ration showed higher values for the enzyme in liver and intestine than chicks from hens on the unsupplemented ration, but at 4 weeks of age there was no significant difference, possibly because of the wide variations within each treatment. With both a breeder and a broiler ration growth of chicks to 4 weeks was significantly less in those whose dams had received the tungsten supplement, and addition of the supplement to the chick ration further decreased the rate of growth to about the same level in both groups. Efficiency of feed utilisation was decreased by the supplement.—J. S. Thomson (Nutrition Abstracts & Reviews)

TESTER, J. R., and L. OLSON.
EXPERIMENTAL STARVATION OF PHEASANTS. *J. Wildlife Management*, 1959, 23, 304-309. [Minnesota Div. Game Fish, St. Paul.]—Groups of wild and artificially reared pheasants were housed in open pens in the shelter of a wind-break or on an exposed site in Minnesota in February 1956, when average maximum temperature was 25° and average minimum temperature 4° F. Wild birds given no feed survived 7 to 15 and artificially reared birds 12 to 26 days. There was no significant difference between sexes or between sheltered and exposed birds. Wild birds lost a slightly higher proportion of weight, about 53 per cent., before death than those artificially reared. Cannibalism was seen only in artificially reared birds, feather picking from the fourth day and eating of dead birds later. By the sixth day some birds appeared listless. In the later stages of starvation a coma-like condition was seen and a squatting position was assumed. Faeces became watery and light in colour and just before death had the consistency and appearance of milk. Histopathological examination of tissues "showed no changes which were thought due to the diet".—R. G. Hankin. (Nutrition Abstracts & Reviews)

TREAT, C. M., and E. L. STEPHENSON.
FACTORS INFLUENCING THE FEEDING VALUE OF RICE AND OTHER CEREAL GRAINS FOR THE TURKEY POULT. *Poultry Sci.*, 1959, 38, 747-750. [Univ. Arkansas, Fayetteville.]—Groups of day-old White turkey poults were fed to 9 weeks of age on a basal ration of soya bean oilmeal and maize containing 42.5 per cent. yellow maize, or on this ration with 25, 50, 75 or 100 per cent. of the maize replaced by similar amounts of either brewer's rice or rough rice. The rations were given as crumbled pellets. At 4 weeks of age growth was depressed only in the group receiving 25 per cent. of the cereal as rough rice; no explanation of this could be given. At 9 weeks of age rations in which brewer's rice completely replaced maize did not support normal growth; when all the maize was replaced by rough rice, growth was significantly improved. Efficiency of feed utilisation was generally reduced by the substitution of rice.

In a further experiment the replacement values of rough rice and barley for maize, each at levels of 50 and 100 per cent., were tested with rations given either as mash or as pellets. With mash rations growth to 4 or 9 weeks was depressed only when barley completely replaced maize; with pelleted rations barley could replace maize entirely. Pelleting of the rations generally improved growth rate to 4 weeks, but at 9 weeks growth rate was significantly improved only when barley replaced all the maize. All replacements reduced efficiency of feed utilisation.—J. S. Thomson. (Nutrition Abstracts & Reviews)

TSCHIDERER, K. Aufbereitung des Sojaschrotes : entscheidend fur Vollwertigkeit.
REFINING SOYA BEAN MEAL : ESSENTIAL FOR ITS FULL VALUE. *Lebensmittel u. Ernahrung*, 1959, 12, No. 2, 7-8.—Groups of 15 day-old chickens were given rations containing 20 per cent. "toasted" American soya bean meal with no urease activity or a German soya bean meal with an activity of 360 mg. NH_3 per g. per 3 hr. Weight gains in 8 weeks were 928.3 and 629.8 g., respectively. The results suggest that inactivation of the trypsin-inhibiting factor gives better protein utilisation.—R. G. Hankin. (Nutrition Abstracts & Reviews)

VERCILLO, A. Sulla decomposizione della lecitina dell'uovo.
DECOMPOSITION OF EGG LECITHIN. *Rend. Ist. super Sanita, Rome*, 1959, 22, 23-31. [Lab. Chim., Ist. Super. Sanita, Rome.] French, English and German summaries.—Degradation of lecithin was measured in powdered egg yolk mixed with different foodstuffs. The lecithinase activity of malt extract increased greatly over a period of months. Olive oil, alone or with lemon, vinegar and salt, had no effect and yeast or milk had only a slight effect on lecithin. Destruction of lecithin

by maize flour and by wheat flour and milling by-products was considerable, but range of values was wide. Addition of yeast, but not of malt extract, to flour and egg pasta greatly increased the lecithinase activity of flour. Acids mixed with the pasta tended to inhibit and Na and Mg salts stimulated activity of lecithinase.—I. R. Anderson. (Nutrition Abstracts & Reviews)

VIDINEEV, M. M. Dikij ris—horosij korm dlja vodoplavajuscej pticy.
WILD RICE, A GOOD FEEDINGSTUFF FOR WATERFOWL. *Pticevodstvo*, 1959, No. 5, 28-29. (Nutrition Abstracts & Reviews)

VIVIANI, R., M. MARCHETTI, and A. M. SECHI. Effetti dell'acido orotico sul pulcino a dieta carente di vitamina B_{12}.
EFFECTS OF OROTIC ACID ON CHICKENS ON A DIET LACKING VITAMIN B_{12}. *Boll. Soc. ital. Biol. sper.*, 1958, 34, 1903-1905. [Ist. Chim. Biol., Univ. Bologna.]—Three groups of 14 chicks 3 days old received a basal diet of whole maizemeal 26, whole wheatmeal 20, defatted soya bean meal 50, $CaHPO_4$ 2, $CaCO_3$ 1, NaCl 0.5 and cod liver oil 0.5 per cent., with, per kg. diet, riboflavin 22, nicotinic acid, 220, calcium pantothenate 110, menadione 22 mg. and $MnSO_4 . 4H_2O$ 2.2 g. The diet was given alone or with 1 or 10 mg. orotic acid per 100 g. After 4 weeks the smaller amount of orotic acid had had no effect, but the chicks given the larger amount were significantly heavier than those given none.—D. Duncan. (Nutrition Abstracts & Reviews)

VOGHT, H. Wie hoch liegt der Eiweissbedarf der Legehennen?
WHAT IS THE PROTEIN REQUIREMENT OF LAYING HENS? *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 671-672. [Kiel-Steenbek.]—Literature is reviewed and the amount of digestible protein available per bird and per kg. bodyweight daily for maintenance of hens of 9 pure breeds and 2 crosses during 4 years of laying trials is tabulated. The requirement is taken as being 24.2 g. digestible protein per 100 g. egg produced.—I. R. Anderson. (Nutrition Abstracts & Reviews)

VOHRA, P., and F. H. KRATZER.
THE EFFECT OF PHENYLALANINE DEFICIENCY ON THE GROWTH AND FEATHER PIGMENTATION OF TURKEY POULTS. *Poultry Sci.*, 1959, 38, 902-906. [Dept. Poultry Husb., Univ. California, Davis.]—The phenylalanine requirement of turkey poults was assumed to be 2.4 per cent. of the diet, or 1.05 per cent. with 1.35 per cent. tyrosine, 1½ times that of the chicken.

A synthetic ration with an amino acid mixture free of phenylalanine and tyrosine was given alone or with 0.45 per cent. DL-phenylalanine, half of which was deemed to be available. The two 3-day-old poults on the unsupplemented ration died within 8 days, and the 2 on the supplemented ration lost weight for 5 to 8 days but regained it and were still alive at 10 days. There was no sign of feather depigmentation.

In the second experiment a ration with 30 per cent. gelatine and amino acids was used; the gelatine supplied 0.69 per cent. phenylalanine and 0.15 per cent. tyrosine and was supplemented for experimental groups in 2 trials with 0.8 per cent DL-phenylalanine, giving a total available phenylalanine content of 1.09 per cent. Birds on the unsupplemented ration maintained weight for 10 days; then deaths occurred and by 22 days only 3 of 20 birds used in the trials were alive. With the supplemented rations average daily weight gains were 3.52 and 3.42 g. per bird. All the 10 birds in one trial and 7 of 10 in the other were alive at 3 weeks. No feather depigmentation was observed in any of the groups.

In a study of phenylalanine antimetabolites it was found that 0.16 per cent. *p*-fluoro-DL-phenylalanine in a Drackett protein ration containing 2.4 per cent. phenylalanine and 0.95 per cent. tyrosine reduced growth rate in poults by 42 per cent. Similar amounts of β-2-thienylalanine or β-phenylserine did not depress growth.—J. S. Thomson— (Nutrition Abstracts & Reviews)

VOHRA, P., and F. H. KRATZER.
THE EFFECTS OF LYSINE, BIOTIN, AND PANTOTHENIC ACID DEFICIENCIES ON THE PIGMENTATION OF TURKEY POULTS. *Poultry Sci.*, 1958, 37, 1047-1050. [Dept. Poultry Husb., Univ. California, Davis.]—In the first series of experiments groups of 3-day-old Broad Breasted Bronze turkey poults received a basal ration containing sesame seed oilmeal, deficient in both lysine and biotin. Other groups received the same ration supplemented with lysine or biotin or both. The experiments ran for 18 days. In comparison with groups given the double supplement, those on the basal ration alone or supplemented with either lysine or biotin showed depression of growth, most marked with the doubly deficient basal ration, less when biotin was added and still less when lysine was added. With the lysine-deficient ration there was severe depigmentation of flight feathers. With the biotin-deficient ration there was no depigmentation, but perosis, dermatitis and broken feathers occurred. These were not evident in lysine deficiency. With the basal ration deficient in both lysine and biotin the syndrome of perosis, dermatitis and broken feathers was less severe than in biotin deficiency alone.

In the second series, over 12 or 19 days, a similar basal ration was used, deficient in lysine and pantothenic acid, and additions were made of lysine or pantothenic acid or both. As in the previous series the double deficiency caused depression of growth and depigmentation of feathers. Lysine added to the basal ration improved growth rate and produced normally pigmented feathers. Added pantothenic acid greatly improved growth rate but did not prevent depigmentation of feathers. In this series there was no evidence of perosis, dermatitis or broken feathers.—J. S. Thomson. (Nutrition Abstracts & Reviews)

WAGNER, J., and E. FRANZEN. Die Bestimmung einiger Stickstoffkomponenten des Harns in vermischten Geflugelexkrementen mit Hilfe der Papierchromatographie und der Papierelektrophorese.
ESTIMATION OF SOME NITROGENOUS COMPONENTS OF THE URINE IN MIXED EXCRETA OF POULTRY BY MEANS OF PAPER CHROMATOGRAPHY AND PAPER ELECTROPHORESIS. *Arch. Tierernahrung*, 1959, 9, 11-22. [Inst. Tiernahrung, Martin Luther Univ., Halle-Wittenberg.]—RF values are given for creatine, creatinine, uric acid, urea, guanidine, sarcosine, guanine, xanthine and allantoin in 10 solvent mixtures and for electrophoretic mobilities of creatine, creatinine, urea and uric acid at differenth *p*H values at 600 V. The nitrogen partition of the excreta of hens maintained on mixed diets was estimated.—H. G. Bray. (Nutrition Abstracts & Reviews)

WALTER, E. D., G. S. LINDBLAD, and J. R. AITKEN.
THE VALUE OF SUNFLOWER SEED OIL MEAL AS A PROTEIN SUPPLEMENT FOR LAYING HENS. *Canad. J. Animal Sci.*, 1959, 39, 45-49. [Canada Dept. Agric. Brandon, Manitoba.]—Hens in individual cages or in floor pens received practical all-mash rations containing fishmeal 2 or 2.5 and meatmeal 8 per cent., or this ration modified by replacing meatmeal with equivalent amounts of protein as sunflower seed oilmeal produced by the expeller process. Partial or complete replacement of the meatmeal by sunflower seed oilmeal had no effect on mortality, egg production or maintenance of bodyweight, but 9.5 or 13 per cent. sunflower seed oilmeal in the diet increased feed consumption. It is concluded that sunflower seed oilmeal is satisfactory as a protein supplement in laying rations, but it is relatively low in energy.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

WATTS, J. H., L. K. BOOKER, J. W. MC AFEE, E. G. WILLIAMS, W. G. WRIGHT, and F. JONES, (Jr.).
BIOLOGICAL AVAILABILITY OF ESSENTIAL AMINO ACIDS TO HUMAN SUBJECTS. 1. WHOLE EGG, PORK MUSCLE AND PEANUT BUTTER.

WATTS, J. H., L. K. BOOKER, J. W. MC AFEE, D. C. W. GRAHAM, and F. JONES, (Jr.).

2. WHOLE EGG, MILK AND COTTAGE CHEESE. *J. Nutrition*, 1959, 67, 483-496; 497-508. [Carver Found., Tuskegee Inst., Ala.]—1. Six healthy male students aged 22 to 28 years participated in 4 experimental periods; 7 days of low N intake from a basal diet mainly of fruits and vegetables, with N-free "Calorie adjustor" (mint wafers), and 3 periods of 10 days on the same basal diet, with whole egg, pork and peanut butter, respectively, to supply 1 g. protein per kg. bodyweight per day and sufficient of the "Calorie adjustor" to make the diet isocaloric with the low-N diet. Urine and faeces were collected during the last 6 days, or the last 4 days of the first period, for estimation of total N and faecal isoleucine, leucine, lysine, methionine, cystine, phenylalanine, tryrosine, threonine, tryptophan and valine.

The average N balances and availabilities of the amino acids were similar for egg and pork. With the exception of tyrosine, average availabilities of the amino acids in peanut butter were consistently lower than of those in egg and pork. Average N retention also was less with peanut butter, because of higher faecal and urinary N excretion.

2. Eight healthy male students aged 24 to 28 years participated in 4 experimental periods of 10 days, like those in the previous experiment. The periods were one with low N intake with sucrose as "Calorie adjustor", and periods with whole egg, milk (3 subjects) or egg and milk (5), and cottage cheese in amounts to supply 1 g. protein per kg. bodyweight per day and sucrose to make the diet isocaloric with the low-N diet. Each balance period was of 6 days.

Except for isoleucine, the availabilities of the amino acids in the milk and egg diet were equal to, or slightly higher than, those of the egg diet. The lowest availabilities were for milk alone, attributed to abnormally high intakes of milk during that period. Availabilities of the amino acids in cottage cheese were higher than of those from milk, but lower, except for isoleucine, leucine and lysine, than of those from milk with egg.—G. F. Garton. (Nutrition Abstracts & Reviews)

WAWRZYNIAK, M.

HISTOPHYSIOLOGIC STUDIES OF THE INFLUENCE OF THE ASCORBIC ACID ON SPERMIOGENESIS IN COCKERELS. *Ann. Univ. Mariae Curie-Sklodowska*, 1956, 11 (Sect. *DD*), 1-56. [Kat. Anat. Zwierzat Wydz. Wet. W.S.R., Lublin.] Polish and Russian summaries. [This report appears to have been published in 1958.]—In order to determine sex easily, Greenlegs cocks were crossed with Sussex hens, the colour of the male and female chicks being different at hatching. Male chicks of the 2 pure breeds were used also. They received a diet normal for the country. Experiments were made in spring and in winter. Groups contained from 10 to 12 birds, 21, 35 or 49 days old. All were killed at the age of 70 days. Ascorbic acid, 50 mg., was injected into breast muscle every 12 hr. for varying periods with varying intervals before and after the injections, and in one series with intervals between groups of injections. Some chicks received no injection of ascorbic acid, only saline. The chicks and their testes were weighed at the end of the experiment. The testes were examined histologically by the method of Stieve *(Ztschr. mikr.-anat. Forsch.*, 1924, 1, 491; 1926, 5, 463; 1928, 12, 232) very slightly modified, with appropriate staining. In sections the number of seminiferous tubules was counted and the number containing primary or secondary spermiocytes was expressed as a percentage of the whole.

[The results are set out in 17 tables, but they are nowhere summarised in any way to facilitate comparison between treatments in the complicated systems of groups.]

It was concluded that vitamin C may accelerate spermiogenesis or may inhibit it. The most effective dose for stimulation was considered to be 50 mg. given by intramuscular injection every 12 hr., 28 times. The most suitable age to begin was 35 days.—E. M. Hume. (Nutrition Abstracts & Reviews)

WISS, O., F. WEBER, R. RUEGG, and O. ISLER. Uber die biologische Aktivitat der Vitamine K_1 und K_2 und ihrer Isoprenologen.

THE BIOLOGICAL ACTIVITY OF VITAMINS K_1 AND K_2 AND THEIR ISOPRENE ANALOGUES. *Hoppe-Seyler's Ztschr.*, 1959, 314, 245-249. [Forschungsabt., F Hoffman,La Roche & Co. AG., Basle.] English summary.—For previous work see Abst. 2985, Vol. 24; Isler *et al.*, *Helv. chim. Acta*, 1958, 41, 786; Isler and Doebel, *Helv. chim. Acta*, 1954, 37, 225.—In tests with vitamin-K-depleted chicks, naturally occurring vitamin K_1, which has 20 carbon atoms in the side-chain, was more effective than synthetic analogues with fewer or more carbon atoms, but not more effective than synthetic vitamin K_1. In contrast, natural vitamin K_2, earlier shown to have a side-chain of isoprene units with 35 carbon atoms in all, was less effective than analogues with 20, 25 or 30 carbon atoms. That with 25 was the most potent. Of those with 20 and 30, 6′ : 7′-mono-*cis* compounds were significantly less effective than all-*trans* or 10′ : 11′-mono-*cis* compounds.—W. M. Deans. (Nutrition Abstracts & Reviews)

WORDEN, A. N., and T. F. REID.

CALCIUM LACTATE AS A DIETARY SUPPLEMENT FOR LAYING HENS. *Vet. Rec.*, 1959, 71, 179-180. [Nutrit. Res. Unit, Huntingdon.]—A preliminary report describes 2 experiments in which calcium lactate pentahydrate replaced an equal weight of calcium carbonate in a basal mash for caged laying hens at levels of 1 and 2 per cent. The experimental mashes had less Ca than is usual in commercial practice, but the basal mash contained enough. The first experiment, with 36 hens including the controls, lasted 8 months. In the second experiment, of which the first 6 months were completed, only the 1 per cent. level of lactate was given.

The results showed that calcium lactate in the amounts given significantly increased egg production and reduced feed consumption.—J. G. Gordon. (Nutrition Abstracts & Reviews)

ZANNELLI, C. Influenza dell'acido ascorbico sull'accrescimento del pulcino.

INFLUENCE OF ASCORBIC ACID ON GROWTH OF THE CHICK. *Quad. Nutrizione*, 1958, 18, 171-181. [Ist. Anat. Fisiol. Animali Domestici, Univ. Milan.] English summary.—Chicks of both sexes were fed to appetite on a balanced diet [not described], and from 7 days of age one group of 10 pullets and 6 cockerels received in water by mouth about 100 mg. ascorbic acid per kg. bodyweight daily for 44 days. Weights were recorded and the comb was measured weekly for the last 3 weeks. Results are shown in a table and graphs.

Pullet chicks showed no significant effect of the ascorbic acid, but male chicks given the vitamin were at the end significantly heavier than untreated chicks, mean 862 against 756 g., and the area of the comb was slightly, not significantly, greater. It is suggested that the vitamin increases the production of testosterone.—D. Duncan. (Nutrition Abstracts & Reviews)

ZIDKIH, Z. A. Povysenie mjasnyh kacestv molodnjaka moskovskih belyh indeek pod vlijaniem otkorma.

IMPROVING THE MEAT QUALITY OF YOUNG MOSCOW WHITE TURKEYS BY FATTENING. *Dokl. Vses. Akad. Sel'skohoz. Nauk*, 1959, No. 6, 30-35.—Moscow White turkeys were found to mature earlier than the Bronze variety under comparable conditions. The White turkeys were used to study the effects of cramming; one group were fed normally on grain and mash, the other group were crammed thrice daily with a mixture of maizemeal, oatmeal, wheat offals and barley meal. It was found inadvisable to start cramming before 140 days of age, because the percentage of bone was too high before that time. Birds were killed at 150 and 160 days, after 10 or 20 days' cram-

ming. Carcase weights of crammed males and females at 160 days were on the average 7275 and 4275 g., against 6820 and 4100 g. for normally fed birds. The crammed males had considerably less liver glycogen and carcase fat than the females, and more muscle. The muscle fibres of crammed turkeys were greater in diameter than those of normally fed birds. The composition of breast and leg muscle is compared.—D. Duncan. (Nutrition Abstracts & Reviews)

PATHOLOGY

ARCHIBALD, R. M., and **P. D. MC KERCHER.**
HAEMATOMA AND DISCOLORATION OF THE HEAD OF CHICKENS AS A SEQUEL TO OESTROGENIC PELLETING. *Canad. J. Comp. Med.*, 1959, 23, 237-238. [Animal Pathol. Labs., Canada Dept. of Agric., Sackville, N.B.]—In a flock of "roaster" chickens 11 weeks old, birds which had received implants of pellets of diethylstilbestrol developed oedema and discoloration of the head and wattles. The birds remained active. In the laboratory the same lesions were produced by implanting similar birds in the usual way, using the apparatus without a pellet. There was no evidence of infection.

Naturally and experimentally affected birds recovered spontaneously after about 3 weeks. The condition may be more frequent than is reported.—T. D. Bell. (Nutrition Abstracts & Reviews)

BRION, A., M. FONTAINE, M. P. FONTAINE, and **C. LABIE.** Encephalomalacie de nutrition du poulet. Etude clinique et lesionelle. Considerations sur l'etiologie.
NUTRITIONAL ENCEPHALOMALACIA IN THE FOWL. CLINICAL STUDY AND STUDY OF THE LESIONS. ETIOLOGY. *Rec. Med. vet.* 1958, 134, 673-687. [Lab. Med. Ecole Vet., Alfort.] English, German and Spanish summaries.—The increasing frequency of nutritional encephalomalacia in poultry prompted the study. Between December 1957 and June 1958 encephalomalacia was found in 30 birds, especially in April, May and June, out of 240 sent from commercial poultry enterprises for post-mortem examination. The disease usually appeared between 4 and 8 weeks of age with arrest of growth, followed by development of nerve signs, loss of equilibrium and locomotor disturbances. Death ensued rapidly. Gross and histological pictures are described.

The nutritive defect in the diet is discussed, and it is considered that, with modern methods of manufacture and preservation, destruction of vitamin E is liable to occur as much through the action of sodium bisulphite as of unsaturated fatty acids.—E. M. Hume. (Nutrition Abstracts & Reviews)

DUNAHOO, W. S., H. M. EDWARDS (Jr.), S. C. SCHMITTLE, and **H. L. FULLER.**
STUDIES ON TOXIC FAT IN THE RATIONS OF LAYING HENS AND PULLETS. *Poultry Sci.*, 1958, 38, 663-667. [Poultry Dept., Univ. Georgia, Athens.]—The first experiment was with 2 groups of 75 White Leghorn hens 2 years old on a maize and soya bean meal ration supplemented with 5 per cent. of either fancy bleachable tallow or toxic fat. After 63 days both groups were given a commercial laying mash for 6 weeks. In hens receiving the toxic fat, laying soon began to fall off and ceased entirely by the ninth week. When a commercial laying mash was given to the toxic fat group a few of the birds began to lay, but laid very few eggs in the next 6 weeks. Hatchability of fertile eggs was seriously affected by the toxic fat. On this ration 12 birds died showing ruptured liver and massive internal haemorrhage but no hydropericardium.

The second experiment was with 3 pens of 70 pullets 12 weeks old, one given a growing mash containing 5 per cent. fancy bleachable tallow for 61 days, the second the same mash with 5 per cent. toxic fat for

2 weeks, after which the toxic fat was replaced by bleachable tallow for the remainder of the period, and the third given the toxic fat ration for the entire period of 61 days. After 61 days all groups were given a commercial laying mash for 94 days. The group given the toxic fat for the first 2 weeks began to lay only after 9 weeks of experiment, 2 weeks later than those on bleachable tallow, and laid 20 per cent. fewer eggs, and hatchability of fertile eggs was less. Birds given the toxic fat for the whole period laid only 5 eggs during the 15-week laying period.Toxic fat depressed growth, but this was compensated for by increased rate of growth after the toxic fat was removed from the ration, and birds given toxic fat for 61 days were actually heavier at 155 days than any of the other groups. Mortality of birds given the toxic fat for 61 days was 67 per cent.; lesions included hydropericardium, enlarged liver, hydroperitoneum and swollen pale kidneys. Hydropericardium was found more often in young birds than in mature hens.—J. S. Thomson. (Nutrition Abstracts & Reviews)

ELLIOTT, S. D., and E. M. BARNES.
CHANGES IN SEROLOGICAL TYPE AND ANTIBIOTIC RESISTANCE OF LANCEFIELD GROUP D STREPTOCOCCI IN CHICKENS RECEIVING DIETARY CHLORTETRACYCLINE. *J. Gen. Microbiol.*, 1959, 20, 426-433. [Dept. Animal Pathol., Univ. Cambridge.]—Of 3 groups of chicks one group had a diet containing 25 p.p.m. chlortetracycline (aureomycin) and another an intermittent supplement of 400 p.p.m. At the end of 12 weeks 12 birds from each group were killed and *Streptococcus faecalis* and *S. faecium* were counted in the caeca. In the birds not given antibiotic *S. faecium* was the predominant streptococcus. In the birds given a constant supplement of chlortetracycline equal numbers of *S. faecalis* and *S. faecium* were found, and in those given antibiotic intermittently *S. faecalis* predominated. The strains of *S. faecalis* from the treated groups were resistant to chlortetracycline, and belonged to one serological type. When chlortetracycline was withdrawn the resistant streptococcus disappeared and a sensitive type, previously found in the control birds, appeared. It is suggested that the sensitive type was suppressed, but not completely eliminated, by antibiotic. The serological types of *S. faecalis* found in the chicks are commonly found in the human intestine.—P. Hobson. (Nutrition Abtracts & Reviews)

FERRANDO, R., and N. VULLIERME. Aspects cliniques et biochimiques de la carence en vitamine A chez le poussin.
CLINICAL AND BIOCHEMICAL ASPECTS OF VITAMIN A DEFICIENCY IN THE CHICK. *Rec. Med. vet.*, 1958, 134, 665-672. [Lab. Alimentation, Ecole Nat. Vet., Alfort.] English and Spanish summaries.—The study was made on 150 Sussex chicks at a specialised breeding establishment where the laying hens received a diet containing 10,000 I.U. vitamin A per kg. On hatching the livers weighed from 0.78 to 1.31 g. and contained from 12 to 120 I.U. vitamin A per g. No relation was found between the depth of yellow colour of the chick's down and the vitamin A reserve of the liver.

Chicks were given from hatching a diet deficient in vitamin A containing, per cent., manioc flour 15, barley flour 55, casein 20, brewer's yeast 5, ground bone 2, NaCl 1 and $CaCO_3$ 2. Within 12 days the liver was almost completely depleted of vitamin A. Growth was almost normal for 3 weeks, then slackened. After 5 weeks, leg weakness appeard and there were muscular tremors, but appetite was normal and there was no sign of xerophthalmia. Death occurred from 4 to 6 days after signs of deficiency first appeared. No change considered specific was found at autopsy. If at the end of the third week 5000 I.U. vitamin A per kg. was incorporated in the diet, recovery took place and by the sixth week the liver reserves were between 12 and 24 I.U. per g.

Introduction of 500 I.U. water-soluble vitamin A into an isolated loop of intestine, and estimation 10 min. later of the amount absorbed, showed a mean amount of 203 I.U., range 120 to 284, for 4 non-

deprived chicks, and 110 I.U., range 15 to 200, for 4 deprived. Capacity to absorb different forms of vitamin A in deprived chicks was tested on 4 groups of 13 deprived for 3 weeks and then given for 10 days 10,000 I.U. per kg. diet as fish liver oil or as a proprietary protected preparation. Feed consumption was measured, and the mean percentage of the amount of vitamin A taken which was found in the liver was for fish liver oil 0.25 and for the other preparations 3.6, 3.7 and 3.6.—E. M. Hume. (Nutrition Abstracts & Reviews)

FISCHER, H. 1959. [Inst. Anim. Husb., Univ. Indonesia, Bogor.]
CROOKED WINGS IN A CHINESE GANDER. *Hemera zoa*, 66: 123-124.—An account is given of a 2-yr-old Chinese gander with bilaterally twisted wings, a condition believed to be recessive in inheritance. A breeding test is in progress. (Animal Breeding Abstracts)

HUNT, J. R., and J. MC GINNIS.
THE OCCURRENCE OF LEG WEAKNESS IN MATURE TURKEYS. *Poultry Sci.*, 1959, 38, 607-611. [Dept. Poultry Sci., State Coll. Washington, Pullman.]—Groups of day-old Broad Breasted Bronze male turkeys were reared to 24 weeks on starter and developing rations containing different amounts of Ca and P, but all with the same Ca : P ratio. Up to 8 weeks one group received a starter ration containing Ca 1.0 and P 0.5 per cent. and 3 other groups had rations with twice as much. From 8 weeks the group on the lower Ca and P starter had a developing ration low in Ca. 1.2, and P, 0.6 per cent. The other 3 groups had developing rations with Ca 1.2, 2.0 and 2.8 and P 0.6, 1.0 and 1.4 per cent., respectively. Leg weakness at 24 weeks was seen only in the birds on the rations highest in Ca and P. Rate of growth was the same in all groups.

In a second experiment day-old poults were given for 3 weeks a ration of maize and unwashed isolated soya bean protein, or the same ration supplemented with nicotinic acid or vitamin E or both, and a control group had a maize and soya bean oilmeal ration. At 8 weeks each experimental group was divided into 4 and given a developing ration of maize and soya bean type alone or with vitamin supplements as before, so that birds on one diet up to 8 weeks had all 4 up to 24 weeks. At 3 weeks all the birds on the isolated protein rations showed hock abnormality, whether they had the vitamin supplements or not, but those on maize and soya bean oilmeal were free of the disorder. This early occurrence of enlarged hock was not related to incidence of leg weakness in mature birds, the incidence at 24 weeks being higher in birds on the soya bean oilmeal starter than in those on the isolated protein ration, which showed a high incidence at 3 weeks of age. —J. S. Thomson. (Nutrition Abstracts & Reviews)

HUNT, J. R., and J. MC GINNIS.
THE PREVENTION OF A PEROSIS-LIKE CONDITION IN TURKEY POULTS. *Poultry Sci.*, 1959, 38, 612-619. [Dept. Poultry Sci., State Coll. Washington, Pullman.]—Turkey poults reared to 4 weeks of age on a ration in which all the protein was supplied as isolated soya bean protein, 34.6 per cent. of the ration, showed an 80 per cent. incidence of hock enlargement. Replacement of 40 per cent. or more of the isolated protein by soya bean oil meal completely prevented the disorder. Growth was severely depressed when the protein consisted entirely of isolated protein, owing possibly to amino acid imbalance, though supplements of arginine, lysine, methionine or glycine did not improve growth rate. Washing the isolated protein in water completely removed or destroyed the substance or substances which produced a 100 per cent. incidence of hock enlargement when the unwashed protein was given. Autoclaving the unwashed protein had little beneficial effect. The substance producing the disorder did not appear to be inorganic, since adding ash from the unwashed protein to the washed protein did not produce the condition. Even moisten-

ing the isolated protein in water greatly reduced the incidence of hock enlargement, but heating the protein had little effect.

With a ration deficient in nicotinic acid, containing washed isolated protein, incidence of hock enlargement was 100 per cent., but the disorder was completely prevented by adding 8 or 12 mg. nicotinic acid per lb.; adding α-tocopheryl acetate or N, N diphenyl-*p*-phenylenediamine had no effect. Very high level vitamin supplementation of the unwashed isolated protein ration showed that a mixture of all vitamins prevented the disorder, but that none of the B complex vitamins individually had any great effect. Several combinations of vitamins gave protection, but they had no common feature.—J. S. Thomson. Nutrition Abstracts & Reviews)

JEFFRIES, C. D., F. HOLTMAN, and J. A. CAMERON. 1959. [Dep. Bact., Univ. Tennessee, Knoxvillle.]

SUSCEPTIBILITY OF CERTAIN STRAINS OF WHITE LEGHORN CHICKENS TO *SALMONELLA PULLORUM*. *Amer. J. vet. Res.*, 20: 350-351.—Of 5 commercial strains of W.L.s tested for susceptibility to *S. pullorum*, the least and the most susceptible, West Line and Babcock resp., were selected for further studies, as they were considered to represent the extremes of susceptibility to *S. pullorum* CDC 3522/51. However, when the $L.D._{\infty}$ for the Babcock strain was compared with that for a number of R.I.R. chicks it was about 100 times greater. (Animal Breeding Abstracts)

KURTZE, H. Beobachtungen und Untersuchungen von sogenannten Ballengeschwulsten in einer Huhnerfarm.

OBSERVATIONS AND STUDIES OF SO-CALLED BALL-TUMOURS ON A POULTRY FARM. *Deutsch. tierarztl. Wochenschr.*, 1959, 66, 386-387. [Prum, Eifel.] English summary.—A disorder of poultry is described, consisting in tumours of the foot extending to the sinews and joints, called in the English summary "bumble-foot". It is attributed to a highly concentrated ration with excess of protein and no green feed. White Leghorn hens were afflicted more than other breeds.—I. Leitch. (Nutrition Abstracts & Reviews)

LLOYD, G. L. 1959. [Gwebi Agric. Coll., Salisbury.]

AVIAN LEUCOSIS COMPLEX IS PROBABLY INHERITED. *Rhod. agric. J.*, 56: 155-156.—Judged by the records of the Gwebi [Southern Rhodesia] poultry flock over the past 9 yrs. heredity would seem to play a greater part than contagion or infection in the spread of lymphomatosis. Mortality from the disease, which had been 5.7 and 6.6% resp. in 1949 and 1950, when the flock was kept closed, was increased with the introduction of 2 cockerels from a source where rigid selection had not been practised. After the 1951-52 season all birds related to any dying from lymphomatosis were culled, whereupon flock mortality showed a steady decrease from 17.4% in 1953 to 4.6% in 1958.

A programme for eliminating the disease from a flock is outlined which, followed by keeping the flock closed, can reduce mortality from avian leucosis complex to 5%. It is doubtful, however, if it will ever fall below this. (Animal Breeding Abstracts)

MARKSON, L. M., R. B. A. CARNAGHAN, and G. B. YOUNG. 1959. [Centr. Vet. Lab. Weybridge.]

FAMILIAL CEREBELLAR DEGENERATION AND ATROPHY —A SEX-LINKED DISEASE AFFECTING LIGHT SUSSEX PULLETS. *J. comp. Path.*, 69: 223-229.—A field history of mild ataxia and tremors of the head and neck developing at 1-2 mths. of age in ♀ chicks was reported from Light Sussex matings in a breeding flock. Apart from the nervous symptoms, the birds reared normally and laid satisfactorily. On the basis of test matings it was concluded that the disease was transmitted by breeding and occurred only in ♀♀. A sex-linked recessive factor would appear to be responsible.

A study of the morbid anatomy showed that gross abnormality and microscopic changes were confined to the cerebellum, which varied in size from half normal to a diminutive nodule of tissue. (Animal Breeding Abstracts)

O'DELL, R. L., P. M. NEWBERNE, and J. E. SAVAGE.
AN ABNORMALITY OF THE PROVENTRICULUS CAUSED BY FEED TEXTURE. *Poultry Sci.*, 1959, 38, 296-301. [Dept. Agric. Chem., Univ. Missouri, Columbia.]—The effect on the proventriculus of adding the constituents of a practical ration to a purified ration was investigated. The purified ration was mainly of washed soya bean protein and glucose, on which 25 per cent. of the chickens had an enlarged proventriculus. When from 48 to 50 per cent. of the soya protein and glucose was replaced by maizemeal, ground wheat or maize grits complete protection was afforded. When the maize products were given in finely powdered form as maize starch, powdered maize or powdered maize grits the incidence of enlarged proventriculus ranged from 17 to 31 per cent. The incidence was highest, 40 per cent., when zein replaced part of the purified ration, and when sand was added the incidence was 10 per cent. Granite grit given to appetite failed to protect. The syndrome was evident within one week of giving the basal ration but appeared to have little effect on the growth of the chickens. Associated with the syndrome was a poorly developed gizzard and frequently a pendulous crop. The histopathology of the enlarged proventriculus is described.—J. S. Thomson. (Nutrition Abstracts & Reviews)

RAHMANOV, A. M. Amiloidoz utok, vyrascivaemyh i otkarmlivaemyh na pticefabrikah.
AMYLOIDOSIS OF DUCKS REARED AND FATTENED ON A POULTRY FARM. *Arh. Patol.*, 1958, 20, No. 11, 59-62. [Vet. Inst., Leningrad.] English summary.—The farm specialised in fattening young ducks by mechanical cramming. A feed mixture containing plenty of protein and including 5 to 10 per cent. meat-and-bone meal, 5 to 10 per cent. fishmeal and 3 to 5 per cent. curds was given into the crop. Histological examination of organs from ducks killed for meat showed a high incidence of amyloidosis. A trial was then made with 3 groups each of 20 ducks fattened in the same way for 19 or 11 days or fed under almost natural conditions; the mean ages of killing were 57, 53 and 105 days. The incidence of amyloidosis was 9, 5 and none.

Amyloidosis was found also in 69 of 92 ducks which died from different causes during fattening; the affected organs were spleen in 97, liver in 66 and kidneys in 21 per cent. No other organ was affected. —D. Duncan. (Nutrition Abstracts & Reviews)

SANGER, V. L., M. S. SCOTT, A. HAMDY, C. GALE, and W. D. POUNDEN.
ALIMENTARY TOXEMIA IN CHICKENS. *J. Amer. Vet. Med. Assoc.*, 1958, 133, 172-176. [Dept. Vet. Sci., Ohio Agric. Exp. Stat., Wooster.]—A new disease in broilers and laying hens was characterised by dysponea, unsteady gait, stunted growth, subcutaneous oedema and sudden death, with a mortality of over 50 per cent. in many flocks. The macroscopic lesions were ascites, hydropericardium, haemorrhages, and swollen, pale, irregular liver covered by a fibrinous membrane.

Microscopic lesions were oedema and haemorrhage under the epicardium, degeneration of the myocardium, hepatic necrosis and fibrosis, petechiae in the liver, haemorrhages and oedema in the adrenal glands and degeneration of the kidneys.

The disease resembled the effects of acute salt poisoning, of vitamin E deficiency and of poisoning by some chemicals and plants, but it could be produced experimentally only when the diet contained from 2.0 to 7.5 per cent. of certain samples of fat which had not been obtained directly from the primary rendering of the extraction process.—M. H. Pierce. (Nutrition Abstracts & Reviews)

SHIFRINE, M., L. E. OUSTERHOUT, C. R. GRAU, and R. H. VAUGHN.
TOXICITY TO CHICKS OF HISTAMINE FORMED DURING

MICROBIAL SPOILAGE OF TUNA. *Appl. Microbiol.*, 1959, 7, 45-50. [Dept. Poultry Husb., Univ. California, Davis.]—Scraps of pre-cooked tuna obtained from canneries were allowed to spoil under different conditions and were then dried, extracted with hexane, and ground to meal. The diferent meals were included at 40 per cent. in a purified diet or added at 20 per cent. to a commercial starter ration for chicks and were given for a week to chicks reared to 12 days of age on a commercial ration. Histidine and histamine were estimated in the meals.

Histamine was produced in most samples during spoilage, whether the material had been exposed to air or tightly packed to produce more or less anaerobic conditions. Samples containing little or no histamine allowed a higher growth rate in chicks than unspoiled tuna, but samples with from 0.12 to 0.4 per cent. histamine depressed growth in proportion to concentration, and the highest concentration caused loss of weight. The toxic samples had little or no offensive odour.

Histamine should be estimated in tuna meals as a routine check, but as fishmeals are usually used at only 5 per cent. in chick rations little danger is expected.—D. Duncan. (Nutrition Abstracts & Reviews)

SIEGMANN, O. Was der Geflugelzuchter uber Kokzidiostatika wissen muss.

WHAT THE POULTRY BREEDER MUST KNOW ABOUT COCCIDIOSTATS. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 153-154. (Nutrition Abstracts & Reviews)

SOKOLOFF, B., M. TOYOMIZU, C. C. SAELHOF, B. MC CONNELL, and F. ZBAR.

EFFECT OF CERTAIN FATTY ACIDS ON ROUS SARCOMA VIRUS. *Growth*, 1958, 22, 215-224. [A. P. Cooke Mem. Cancer Lab., Florida Southern Coll., Lakeland.]—Six quaternary compounds, in low concentration, inactivated Rous sarcoma virus *in vitro* and in eggs. Fatty acids did not inhibit in chick embryo, except that some were slightly inhibitory when oxidised, but several were inhibitory *in vitro*, and then oxidation of all highly unsaturated fatty acids resulted in inactivation of the virus.—E. Hobson. (Nutrition Abstracts & Reviews)

SZEPSENWOL, J.

TUMORS FOUND IN CHICKENS MAINTAINED ON AN EGG DIET. *Poultry Sci.*, 1958, 37, 1350-1352. [Dept. Anat., Sch. Med. Univ. Puerto Rico, San Juan.]—Of 15 New Hampshire chickens fed continuously for 28 months on eggs obtained from a hatchery after incubation for 3 weeks, 4 were found to have tumours in the ovary. The pathology is described.

In another experiment with 5 White Plymouth Rocks kept for 19 months, 2 out of 3 on an egg diet developed tumours and their ovaries weighed 20 and 12 g. Controls on a normal diet did not develop tumours and their ovaries weighed 7 g. Further work is in progress.—J. S. Thomson. (Nutrition Abstracts & Reviews)

WAIBEL, P. E., and B. S. POMEROY.

EFFECT OF DIET ON THE DEVELOPMENT OF BETA-AMINOPROPIONITRILE-INDUCED VASCULAR HEMORRHAGE IN TURKEYS. *J. Nutrition*, 1959, 67, 275-288. [Dept. Poultry Husb., Coll. Agric., Univ. Minnesota, St. Paul.]—Aortic and cardiac haemorrhage were produced in Broad Breasted Bronze and White turkey poults when they were given rations based on maize and soya bean meal with 0.4 to 0.8 per cent. β-aminopropionitrile fumarate added. When 15 per cent. of any of 6 samples of fishmeal was given in the ration, deaths due to the disorder were hastened. Other dietary ingredients tested were animal or vegetable fats as 15 per cent. of the ration, cereal by-products as 20 per cent. and alfalfa meal or dried whey as 10 per cent.; none affected the course of the disorder. Triodo-L- thyronine, 2.5 mg. per kg. feed, did not inhibit the effect of β-aminopropionitrile.—I F. Duthie. (Nutrition Abstracts & Reviews)

MARKETING AND POULTRY PRODUCTS

HOHLS, H. W. Mastfahigkeitsvergleich zwischen Leghorn und Cornish × White-Rocks-Kreuzung bei drei verschiedenen Futtermischungen.

COMPARISON OF FATTENING CAPACITY OF LEGHORNS AND CORNISH × WHITE ROCKS ON THREE DIFFERENT FEEDS. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 724. [Bundesforschungsanst. Kleintierzucht, Celle.]—Feeds containing 10 per cent. beef fat and 5 p.p.m. procaine penicillin and differing only in crude protein content, 24.2, 20.8 and 16.3 per cent., were tested with Leghorns and Cornirocks. Cornirocks required less feed than Leghorns per kg. gain. There was little difference between the rations with 24 and 21 per cent. protein. Weight gain in 9 weeks was 35 to 50 per cent. higher in Cornirocks and was best, 1.4 kg., on the highest protein. Lowest weight gain and feed efficiency in the Cornirocks, given 16 per cent. protein, were better than the best results for Leghorns. Cornirocks had better carcase quality and yields. Fattening Leghorns was uneconomic.—R. G. Hankin. (Nutrition Abstracts & Reviews)

LANDAU, L., V. PETER, and **A. SPRONC.** Versuch einer intensiven Mast von Puten-Broilern.

EXPERIMENT ON INTENSIVE FATTENING OF TURKEY BROILERS. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 727. [Lab. Physiol. Landwirtsch. Nutztiere, Ivanka pri Dunaji, Czechoslovakia.] (Nutrition Abstracts & Reviews)

MUCCIOLO, P., and **I. S. SCHNEIDER.** Algumas observacoes sobre a eficienica da clortetraciclina na conservacao de carnes vermelhas, de aves e de pescado.

THE PRESERVATION OF RED MEAT, POULTRY AND FISH WITH CHLORTETRACYCLINE. *Arq.brasil. Nutricao*, 1958, 14, No. 1, 15-35. [Fac. Med. Vet., Univ. Sao Paulo.] English summary.—Acronize M, PD or BI (American Cyanamid Co.), containing, respectively, 2.3, 10.0 and 16.5 per cent. chlortetracycline, was used in each of the following experiments. A solution of Acronize M was injected into beef and veal carcases. At room temperature, 15.5° to 28.8° C., they remained edible for 5 days and at 2° to 4° C. for 30 days. There was no adverse effect on taste or odour. Pork carcases treated with Acronize M kept for 90 hr. at room temperature, and sausages and certain individual cuts treated with a solution of Acronize PD remained edible for twice the normal period. Poultry carcases immersed for 1 hr. in a cold solution of Acronize PD could be kept for 48 hr. at room temperature and for 26 days in a refrigerator. Fish and shrimps preserved in ice which had been treated with Acronize BI remained edible for, respectively, 144 and 96 hr. at room temperature if the treatment was repeated every 24 hr. Fish fillets and shrimps immersed in a solution of Acronize PD, packed in ice and stored in a refrigerator were still edible after 36 and 32 days, respectively.—I. R. Anderson. (Nutrition Abstracts & Reviews)

ROY, M. Le poulet de gril.

BROILERS. *Rev. d'Oka*, 1958, 32, 97-119. (Nutrition Abstracts & Reviews)

SWENDSEID, M. E., R. J. FEELEY, C. L. HARRIS, and **S. G. TUTTLE.**

EGG PROTEIN AS A SOURCE OF THE ESSENTIAL AMINO ACIDS. REQUIREMENT FOR NITROGEN BALANCE IN YOUNG ADULTS STUDIED AT TWO LEVELS OF NITROGEN INTAKE. *J. Nutrition*, 1959, 68, 203-211. [Dept. Home Econ., Univ. California, Los Angeles.]—Men and women aged from 19 to 30 years took diets containing different amounts of whole egg, with glycine, or glycine and diammonium citrate, added to make a total N intake of 6.5 or 13 g. per day. At the lower intake, 3 men stored N, or approached equilibrium,

at 80, 100 and 120 g. egg daily, respectively. Four women all stored N at 100 g. and lost N at 80 g. egg daily. At 13 g. N per day 2 men and 1 woman stored N from 80 g. egg, 3 women from 100 g., 1 man and 2 women stored N or approached equilibrium at 150 g., and 1 man approached balance only at 200 g. egg per day. Six subjects were studied at both levels; the amount of egg protein required to maintain N balance slightly decreased for 1 man, remained the same for 3 women, and increased for 1 man and 1 woman when the intake of N was increased.—M. M. Barnes. (Nutrition Abstracts & Reviews)

MANAGEMENT

BAILEY, B. B., J. H. QUISENBERRY, and J. TAYLOR.
A COMPARISON OF PERFORMANCE OF LAYERS IN CAGE AND FLOOR HOUSING. *Poultry Sci.*, 1959, 38, 565-568. [Dept. Poultry Sci., Texas Agric. and Mech. Coll., College Station.]—Day-old White Leghorn pullets from 4 stocks were reared together to 147 days of age, then moved to cages or floor pens for laying tests of 11 periods of 28 days. All received the same all-mash laying ration.

On the whole caged birds had better egg production, egg weight and bodyweight and efficiency of feed conversion. The response to type of housing differed significantly among stocks.—J. S. Thomson. (Nutrition Abstracts & Reviews)

BAILEY, B. B., J. H. QUISENBERRY, and J. TAYLOR.
A COMPARISON OF THE SUBSEQUENT LAYING HOUSE PERFORMANCE OF RANGE AND CONFINEMENT REARED PULLETS FED ALL-MASH AND MASH AND OATS. *Poultry Sci.*, 1959, 38, 559-564. [Dept. Poultry Sci., Texas Agric. and Mech. Coll., College Station.]—Day-old sexed Leghorn pullets of 5 different stocks were brooded together till 11 weeks; then one-half of each stock was transferred to range and the rest were kept in confinement. One-half of each stock under each system of rearing was given an all-mash ration and the other half mash with free access to oats. The range had little vegetation after the first few weeks. At 21 weeks all the birds were housed for egg production tests for 11 periods of 28 days, during which an all-mash ration was given.

Method of rearing had no significant effect on overall egg production, average figures being 63.65 per cent. for range and 63.15 per cent. for confinement rearing. Average egg weight for range rearing was 56.1 g. and for confinement rearing 55.05 g.; the difference was highly significant. Overall efficiency of feed conversion was similar under both rearing systems, but the higher efficiency of the birds reared on range during most of the experiment was offset by poorer efficiency during the first 28 days. Average age at sexual maturity was 170.7 days for range rearing and 162.45 days for confinement rearing, a highly significant difference. Average age at 50 per cent. production was significantly less in the birds reared in confinement, but after 28 days of the laying period bodyweight was higher in range-reared birds and remained so till the end of the test. The use of oats free choice in the rearing period had no effect on the characteristics studied during the laying periods, and there was no interaction between rearing method and breeding stocks.—J. S. Thomson. (Nutrition Abstracts & Reviews)

CLARK, J., and A. M. CHALMERS.
COMMERCIAL EGG PRODUCTION COSTS. *N. of Scotland Coll. Agric., Agric. Econ. Dept., Econ. Rep.* No. 77, February 1959, pp. 12.—The data were from 3 free-range, 6 battery and 13 deep-litter flocks. Average cost of feed was 56 per cent. of total costs. Feed per bird cost most in batteries, least on deep litter; profit per bird and per doz. eggs was greatest in batteries, and there was a small loss on free range. Average feed consumed per bird and per doz. eggs was higher than is usually recorded in experimental work, and it is important to reduce it

by good management. In each system there were some farms which made a profit and some a loss. The balance was related to costs of production, but more important was the level of production at the time when the price of eggs was high. Management to take advantage of high prices is discussed.—T. D. Bell. (Nutrition Abstracts & Reviews)

HALL, M. D.
TURKEY RAISING IN VICTORIA. *J. Agric., Victoria*, 1959, 57, 69-76. (Nutrition Abstracts & Reviews)

HAVERMANN, H. Gedanken zur Neugestaltung der Huhnerleistungsprufungen in Deutschland.
REORGANISATION OF LAYING TRIALS IN GERMANY. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 309-313.—The present system of laying trials in Germany is inadequate. The number of birds tested is too small, the birds are reared under variable conditions and choice of birds for testing is sometimes left to the individual breeder. Methods used in the United States, Great Britain and the Netherlands are described, with examples of results. A reorganization of the German system on lines similar to the Dutch is recommended.—R. G. Hankin. (Nutrition Abstracts & Reviews

JANCIC, S. 1958. [Inst. Livestock Breed., Univ. Zagreb.] Produktivna svojstva domace licke kokosi u ekstenzivnim uzgojnim prilikama.
PRODUCTION OF THE NATIVE LIKA HENS UNDER EXTENSIVE METHODS OF MANAGEMENT. *Stocarstvo*, 12: 538-546.—In the district of Lika, from which the native fowls take their name, egg recording was started in 1956-57. In the 1st yr. production averaged 125.68 eggs and in the 2nd yr. 123.85 eggs; egg weight averaged 55 g. (38-69). Production was highest in April and May. The fowls had an av. live weight of 1.64 kg. and dressed out at 78% Data are tabulated. (Animal Breeding Abstracts)

KELLEY, R. B., and R. M. DEVARAJ. 1959. [Vet. Dep., Singapore.]
STUDIES ON INCUBATION AND BROODING. STUDY V. *J. Malay. vet. med. Assoc.*, 2: 85-93.—Of 5398 eggs from matings of purebred Canton-type fowls, 72.3% were accepted for incubation of which 5.1% were infertile, 7.3% had chicks dead in shell and 87.6% hatched. The corresponding figures for Canton-type×Brown Leghorn and for imported Brown Leghorn matings were resp. 5497, 73.1%, 10:5%, 8.3% and 81.5%, and 4524, 59.7%, 17.4%, 15.4% and 67.1%. Percentage mortality of chicks to 6 wks. of age was 4.3 for the purebred B.L.s *v.* 2.04 for the Canton-type and 1.9 for the crossbreds.
Percentage lay was 14% greater in the imported B.L.s than in the Canton-type pullets; otherwise the latter were superior in all aspects studied. (Animal Breeding Abstracts)

KING, S. C., and D. F. BRAY. 1959.[North Central Reg. Poult. Breed. Project, Purdue Univ., Lafayette, Ind.]
COMPETITION BETWEEN STRAINS OF CHICKENS IN SEPARATE *VERSUS* INTERMINGLED FLOCKS. *Poultry Sci.*, 38: 86-94.—Randomly selected pullets from 10 strains of Rhode Island Reds, White Leghorns, and white-feathered hybrids were reared and/or housed, separately and/or intermingled. For 8-wk. weights, the R.I.R.s competed more favourably in intermingled pens, at the expense of the light breeds, than in separate pens within their own strain. There was no rearing by strain-within-breed interaction for 8-wk. weights. However, this interaction was significant for egg production to 1st Feb. and "intensity" (*i.e.*, percent production during a 2-mth. period of peak production in the beginning of the laying period), but was not significant for age at 1st egg, egg weight, annual egg production, "persistency" (percent production during the last 2 mths. in the laying house), mortality, and 32- or 55-wk. body weights. The significant competition effects, being small, are only of borderline biological importance.

Intermingled rearing could be used in large-scale tests of experimental varieties for screening out the top 10-20% of each strain, which could then be tested further under separate rearing. (Animal Breeding Abstracts)

KUBICEK, J., and **V. OREL.** (Agric. Univ., Brno, Czechislovakia) Navrh jednopatrove haly pro intensivni vykrm kurat na bluboke podestylce.

THE PURPOSE OF THE PROJECT STORY BROILER HOUSE ON THE BUILT-UP LITTER. *Sbornik Csazv zivocisna vyroba* 4(10), 741-754.—The purpose of the project story broiler house with the project of natural ventilation on and with mechanization of feeding and watering chickens. On one floor 7,500 chickens are to be fed on the area 574 sq. m. (36 x 12). The building of proposed broiler house is about 25 per cent cheaper.—V. Orel.

MAC FARLANE, I., N. S. MORRELL, and **A. H. ROWE.**

POULTRY MANAGEMENT IN THE SYDNEY AREA. *Quart. Rev. Agric. Econ.*, 1959, 12, 9-14.—The economic position of 14 farms specialising in full-time commercial egg production was studied. On 4 farms with high returns egg production per laying hen was 193 eggs at a feed cost of 104 lb., on 5 farms with medium returns it was 159 eggs from 97 lb. feed, and on 5 farms with low returns or actual cash loss, 180 eggs from 104 lb. feed. The variation in quantity and cost of feed suggests that on many farms there is scope for substantial saving. In general heavy fixed costs are better covered with big flocks of birds.—R. G. Hankin. (Nutrition Abstracts & Reviews)

MAKAROV, I. L., and **M. I. ZILINKO.** 1959. Ohlazdaem jaica s pervogo dnja.

COOLING EGGS FROM THE FIRST DAY. *Pticevodstvo*, 9(10): 20.—At the Kalinin State Farm in the Zaslavl district, starting on the first day of incubation, duck eggs were cooled daily to 29°-30° [? C.] for 1½-2 hrs. at 7 a.m. and 7 p.m. Hatchability was 97.5% *v.* 65% for those cooled only from the 8th day of incubation. (Animal Breeding Abstracts)

MAULDON, R. G.

A LEAST COST FEED FOR LAYING HENS USING LINEAR PROGRAMMING. *J. Austral. Inst. Agric. Sci.*, 1958, 24, 353-357. [Inst. Agric., Univ. W. Australia, Nedlands.]—A number of ingredients of feed, with their cost, and content of different nutrients, are set out. The minimum requirement of each nutrient for laying birds is given and the cost is calculated of the quantity of each ingredient necessary to ensure that these requirements are met, for each nutrient. Some ingredients are eliminated at this stage of the analysis by finding whether the quantities of an ingredient which meet each nutrient requirement are greater than each of the corresponding quantities of some other ingredient. The remaining ingredients are subjected to a linear programming technique which solves the problem of finding the most economic combination of them to meet all the nutrient requirements.

If conditions are inserted into the programme, such as determining what the Ca : P ratio should be, this leads to different solutions. The cost and composition of some such computed diets are compared with diets recommended elsewhere.—A. W. Boyne. (Nutrition Abstracts & Reviews)

MORRIS, R. H. 1959.

FIRST WESTERN AUSTRALIAN RANDOM SAMPLE EGG LAYING TEST. *J. Dep. Agric. W. Aust.*, 3rd Ser. 8: 297-318.—The 1st Western Australian Random Sample Laying Test was begun in 1957 at the Poultry Research Station, Herdsman Lake. At first, only commercial-grade chicks, as distinct from breeders-grade chicks, were

accepted, but in future entries of purebred stock will also be admitted, providing the hatcherymen sell at least 2000 ♀ chicks of the breed for which application is made in that year. Each entry consists of 55 day-old sexed pullets and the test officially begins at 8 wks., when 48 pullets are selected. They are on range from 9 till 18 wks. and then undergo a 50-wk. laying test. In 1957, 27 entries from 27 commercial hatcheries were received. The av. number of eggs laid per bird on a hen day basis was 190.4 and weight averaged 2.12 oz. (Animal Breeding Abstracts)

PATRIK, I. A. Vyrascivanie utjat na mjaso.
REARING DUCKLINGS FOR MEAT. *Pticevodstvo*, 1959, No. 4, 16-20 (Nutrition Abstracts & Reviews)

RESETOVA, M. D. 1959. Vosproizvoditeljnaja sposobnostj vysokoproduktivnyh kur posle perevoda iz kletok na vygula.
REPRODUCTION IN HIGHLY PRODUCTIVE HENS TRANSFERRED FROM BATTERIES TO FREE RANGE. *Pticevodstvo*, 9(7): 8-12.—In 1956-58 at the Kuncevsk Poultry Farm in Moscow Province, 6050 Russian White hens were transferred to free range after being kept in individual cages for 6, 9 or 12 mths. During the first 10 mths. on free range egg production was greater than that of the controls (110-115 *v.* 107-108.9 eggs); the difference was greatest for hens transferred in March. Hatchability of eggs laid by experimental hens was 1.4-4% higher. (Animal Breeding Abstracts)

SAMUEL, E. Ein praktischer Futtersilo fur jede Geflugelhaltung.
A PRACTICAL FEED SILO FOR EVERY POULTRY FARM. *Deutsch. Wirtschaftsegeflugelzucht*, 1959, 11, 177. (Nutrition Abstracts & Reviews)

SAVEL'EV, I. K. Vybor porod kur dlja polucenija pomesej i nekotoryc osobennosti vyrascivanija mjasnyh cyplјat.
CHOICE OF BREEDS OF POULTRY FOR CROSSING AND SOME PARTICULARS ON REARING TABLE CHICKENS. *Pticevodstvo*, 1959, No. 9, 6-12—Zagorski chickens grow rapidly and utilise feed well. Development is satisfactory on rations containing a large amount of vegetable protein with supplementary trace elements, antibiotics and vitamin B_{12}, and on rations containing high levels of animal protein without the supplements.

Zagorski × Cochin Jubilee chickens have high liveweights and good carcase quality and feed utilisation. It is possible to rear broilers by using only 2 rations, one from hatchng to 70 days and a second from 71 to 90 days. The composition of the 2 rations is tabulated.

Temperatures of 30° to 32° C. during the first 5 days of life, first feed not later than 12 to 15 hr. after hatching, and exposure to light for 17 hr. per day gave rapid growth and development. —R. G. Hankin. (Nutrition Abstracts & Reviews)

SCHIFFERER, A. Sollen wir unsere Huhner eigentlich satt futtern?
SHOULD POULTRY BE FED TO APPETITE? *Deutsch. Wirt. schaftsgeflugelzucht*, 1959, 11, 599; 601. [Charlottenhof.]—It was suggested that chickens and young hens, turkeys up to about 10 weeks of age and ducklings should be fed to appetite but that self feeders for older birds which were able to look for a part of their feed out of doors and were not intended primarily for the table were uneconomic, except for those containing laying meal for hens. Feed should be carefully weighed out and given 2 or 3 times daily. In May turkeys could obtain all the nourishment they required from grass and wild plants.—I. R. Anderson. (Nutrition Abstracts & Reviews)

SCHOTT. Gedanken zur Rentabilitat der bauerlichen Geflugelhaltung.
ECONOMICS OF POULTRY-KEEPING ON THE FARM. *Deutsch. Wirtschaftgeflugelzucht*. 1958, 10, 934-936. [Nurtingen am Neckar.]—In Germany consumption of eggs per head per annum increased from

133 in 1950 -1952 to 201 in 1957 and consumption of poultry meat from 1.2 to 2.4 kg. Production of eggs was only 135 per laying hen, compared with 170 in Denmark and 200 in The Netherlands. In 1957 Germany imported 4500 millon eggs and 37 per cent. of poultry meat used.

Feed accounts for over 60 per cent. of total costs in poultry production in Germany. Egg production must be at least 170 per bird annually to be economic. It is concluded that there are not enough young hens, the average poultry holding is too small and badly managed, and often poor hygiene encourages the spread of infection.—R. G. Hankin. (Nutrition Abstracts & Reviews)

SIEGEL, P. B., H. S. SIEGEL, C. Y. KRAMER, and **C. E. HOWES.** FEEDER AND WATER ALLOWANCES FOR BROILER CROSSES. *Virginia Agric. Exp. Stat. Res. Rep.* No. 27, May 1959, pp. 8. —The effects and interrelations of sex, cross-breeding and allowance of space for feeding and drinking on growth of broilers were studied on over 4000 birds. Birds allowed 1.5 in. feeder space up to 3 weeks of age, and 3 in. thereafter were heavier than those allowed either 1 in. to 3 weeks, with 2 in. thereafter, or 2 in. to 3 weeks and 4 in. thereafter. The 2 sexes responded similarly to varying amounts of feeder and water space. Different crosses responded differently to changes in allowance of feeder space. Efficiencies of feed conversion were similar for all combinations of feeder and water space.—E. M. Cruickshank. (Nutrition Abstracts & Reviews)

SOBOLEVA, A. M., and **N. A. TUROVIC.** 1959. Pocemu my otkazalisj ot povorota gusinyh jaic na 180°.
WHY WE DID NOT TURN GOOSE EGGS THROUGH 180°. *Pticevodstvo*, 9(10): 21.—In 1958 during incubation 81,000 goose eggs were turned only once daily and hatchability averaged 80%. In 1959 an experimental batch of 123 eggs was not turned during incubation and hatchability was 97.7% *v.* 82.7% for all batches. Further batches of 300 and 855 eggs were not turned and hatchability was 83.3 and 84.2% resp. (Animal Breeding Abstracts)

VOGT, H. Versuch einer Rentabilitatsberechnung je eingestallter Henne.
ATTEMPT TO COMPUTE THE RETURN PER BATTERY HEN. *Deutsch. Wirtschaftsgeflugelzucht*, 1959, 11, 595-598. [Kiel-Steenbek.]—A specimen balance sheet indicating fixed costs, DM 24.80, and variable costs, 4 Pf. per egg, also egg and carcase yield per battery hen for 1 year is presented. Feed requirements of a laying hen of bodyweight 1750 g. were given as grain 18.25 and laying meal 10.2 kg., valued at DM 12.66, plus about 75 g. laying meal per egg of 56 g., representing about 3.7 Pf. The return was calculated on the basis of egg yield 170, price 17 to 20 Pf. each. A simplified chart of returns is shown also. (Nutrition Abstracts & Reviews)

WALVOORT, G. J. H. Technisch en enconomisch optimum.
TECHNICAL AND ECONOMIC OPTIMUM. *Landbouwk. Tijdschr.*, 1959, 71, 100-104. [Landbouw-Econ. Inst., The Hague.]—Liveweights, feed intake, costs and protein content of rations are compared in graph form. The "economic optimum" is estimated from the difference between income and costs and will depend on variations in prices. Trials with chickens (see Cornelissen, Abst. 4973, Vol. 29) are taken as an example.—R. G. Hankin. (Nutrition Abstracts & Reviews)

WYNE, J. W., M. G. MC CARTNEY, R. D. CARTER, and **V. D. CHAMBERLIN.**
THE EFFECT OF DEBEAKING AND WING-CLIPPING ON GROWTH AND LIVABILITY OF TURKEY POULTS. *Poultry Sci.*, 1959, 38, 831-833. [Dept. Poultry Sci., Ohio Agric. Exp. Stat., Wooster.] —The effect of debeaking at one day of age or at 2 weeks and of

wing-clipping electrically or with surgical shears at one day on growth and survival to 4 weeks was tested with small-type White and large-type White turkeys. As compared with untreated controls only debeaking at one day greatly decreased growth rate, in both types of poult. Viability was not affected by any of the treatments and ranged from 65 to 77 per cent. for the small-type and from 95 to 97.5 for the large-type Whites.—J. S. Thomson. (Nutrition Abstracts & Reviews)

GENERAL

AUSTRALIA: COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION. 1958.

POULTRY RESEARCH IN AUSTRALIA. *10th Rep. C.S.I.R.O. Aust.* 1957-58: 40.—At the Poultry Research Centre, Werribee, long range studies in population genetics were continued. The findings from an analysis of egg production of the 1956-hatched L generation pullets are summarised. These include the following: (1) The selected, production-bred flock of White Leghorns averaged 201.4 eggs on a hen-housed basis, which was 41 more than unselected controls; (2) three inbred strains exceeding 70% inbreeding produced, on a survivor basis, about as many eggs as non-inbred controls, but mortality was high in 2 strains; (3) three-way incrosses were disappointing and this method of producing hybrid chickens is not promising. (4) A study of 9 generations of single crossing between W.L. and Australorp confirmed the high amount of heterosis shown by this cross for egg yield of survivors, hatchability and chick mortality [see *A.B.A.* 27, No. 1064], but the view that W.L.×Australorp is superior to Australorp×W.L. was not confirmed; studies on heritability of chick mortality were completed. (5) Results of an experiment to show the effect on egg yield of 3 levels of protein using W.L., Australorp and reciprocal crosses do not appear to indicate significant interaction. (Animal Breeding Abstracts)

BAELUM, J. 1959. Fjerkraeholdet i 1958.

POULTRY IN 1958. *Tidsskr. Landokon.*, 1959 (5): 161-180.—In July 1958 in Denmark there were 26,250,000 laying fowls, 593,000 ducks, 225,000 geese and 61,000 turkeys. There were 83 breeding centres, each with an average of 498 hens; White Leghorns were bred at 46 of the centres and Brown Leghorns, Hampshires, Rhode Island Reds, Plymouth Rocks and Sussex at the remainder. The White Leghorns and Rhode Island Reds averaged 240 eggs and the other breeds 221-229. A total of 94 groups representing 6 breeds were tested for egg production at Favrholm and a total of 13,500 chicks representing 5 breeds were fattened for meat at Hong. Data on demonstration farms and exports are included. (Animal Breeding Abstracts)

[GREAT BRITAIN]: AGRICULTURAL RESEARCH COUNCIL. 1959.

POULTRY RESEARCH IN GREAT BRITAIN. *Rep. agric. Res. Coun.*, 1957-58: 13-25. A review of all aspects of research in progress. (Animal Breeding Abstracts)

MC ARDLE, A. A. 1959.

TEST RESULTS GIVE GUIDE TO EGG PRODUCTION LEVELS WITH PULLETS. *J. Dep. Agric. S. Aust.*, 63: 37.—A diagram is given of the production of pullets in the 1958-59 Egg to Layer Test [held at Parafield Poultry Experiment Station]. The laying test covered the period 1st April 1958 to 16th March 1959. On a hen-housed basis, crossbreds averaged 220 eggs, White Leghorns 187 eggs, Australorps 178 eggs, and Rhode Island Reds 153 eggs. [For the previous results see *A.B.A.*, 27, No. 460.] (Animal Breeding Abstracts)

MURUSIDZE, D. N., V. I. MIHALEV, and Ju. N. PAVLOV. 1959. [Agric. Inst., Blagoveshchensk, Bashkir A.S.S.R.] Mestnye porodnye gruppy kur priamurjia.

LOCAL BREED GROUPS OF FOWL ON THE BANKS OF THE

AMUR RIVER. *Pticevodstvo*, 9(10): 32-33.—Leghorns are the most widely distributed fowls on the banks of the Amur River but they are not thrifty. Three local breed groups should be further developed. They are the Red fowls introduced in the 1930s from Cherkasy and other provinces, the Grey introduced in 1930 from Tambov Province and Krasnodar Territory, and the Speckled fowl which has been bred in Amur Province for the last 50-60 yrs. The body weight of the Reds is greatest (2.8-3.0 kg. for ♂♂ and 2.2-2.8 kg. for ♀♀), and is not appreciably different in the other 2 breeds (2.4-2.8 kg. and 2.1-2.4 kg. for ♂♂ and ♀♀ resp.). The production of the Reds averages 130-150 eggs per yr. weighing 64-67 g., and that of the other 2 breeds 110-150 eggs weighing 55-60 g. (Animal Breeding Abstracts)

NAIDU, P. M. N. 1959.
POULTRY KEEPING IN INDIA. With foreword by S. K. Dey and preface by M. S. Randhawa. *New Delhi: Indian Council of Agricultural Research.* xviii+293 pp. [B.] Price: Rs. 19.80.—This extremely well written and well produced book could be read with profit by anyone interested in poultry husbandry and its associated problems, no matter where they live. It is fitting that this book, the subject matter of which is equally applicable to other countries of the Orient, should come from that sub-continent where the ancestor of all our present day breeds of fowl still leads its jungle existence.

This book is a direct result of the demand for information following the success of the Community Development Scheme in encouraging poultry keeping. The First Five Year Plan, of which this Scheme was a part, is now followed by a Second Five Year Plan, under which it is proposed to establish several Regional Poultry Farms, and a large number of Development Centres in the breeding areas.

The first three chapters deal with distribution of poultry in India, the development of poultry, the economics of production, breeds and how to choose one most suited to the prevailing conditions. Then follows a brief but adequate description of the anatomy of the fowl, and of egg formation. Poultry breeding programmes are then discussed, and the principles of stock improvement. Subsequent chapters deal with artificial incubation and its pitfalls, brooding and rearing, and a particularly good section on housing and equipment most suited to local conditions and using local materials. In the chapter on feeding principles and practices, a brief but adequate review of the composition of the main available foodstuffs is given, while the functions of the vitamins are satisfactorily summarised. A number of typical rations are given in detail, one of which the reviewer has seen to produce very satisfactory results in feeding trials on Government Farms in Thailand. An ingenious method of augmenting animal protein by trapping nocturnal insects with adequately protected lamps in the poultry house is described.

The chapter on diseases and their control is prefaced by consideration of the various hazards to livestock faced by the Indian poultry farmer. Highest amongst these, surprisingly enough, is loss through avian, mammalian and reptilian predators (50%). Then follow the infectious disease due to viruses, bacteria, protozoa, helminths, insect parasites, and moulds, the main point of which are all concisely dealt with. Brief mention of certain non-specific diseases is made. The only criticism one would make here is that figures 149 and 150, especially the latter, appear to be more typical of adenocarcinoma of the reproductive organs than of leucosis as stated.

The book concludes with chapters on management and marketing and a note on capon production. There is a good bibliography and index and misprints are few and far between. (Animal Breeding Abstracts)

NAWROCKA, R. 1959. Fermy drobiarskie w PGR.
STATE POULTRY FARMS IN POLAND. *Przegl. hodowl.*, 27(7): 53-54.—An expansion of poultry breeding took place in 1950 with the

development of state poultry farms by the Polish Central Administration for State Farms. In 1953-54 greater attention began to be paid to pedigree breeding and large importations of purebred cocks were made. At present the main function of the state farms is to produce breeding stock with the object of improving the quality of Polish flocks. (Animal Breeding Abstracts)

RHODESIA AGRICULTURAL JOURNAL. 1959.

39th ANNUAL EGG LAYING TEST. *Rhod. agric. J.*, 56: 71-75.—In the 39th test held at Gwebi College of Agriculture from 1st March 1958 to 30th Jan. 1959 egg production per bird averaged 206.19 on a survival basis and 191.75 on a hen-housed basis. The mortality rate of 7% was well below the average for other years. Leucosis was still the highest single cause of deaths (36%), and this stresses the need for continuous care in the selection of breeding stock. [See *A.B.A.*, 26, No. 2154 for previous test.] (Animal Breeding Abstracts)

STANHOPE, W. 1959.

FIRST RANDOM SAMPLE LAYING TEST. ANNUAL FIELD DAY AND COMMENTS ON RESULTS. *J. Agric. Vict.* 57: 499-504, 532.—The test covered a period of 600 days from the hatching of the eggs on 20th Aug. 1957 to the calculation of carcass value on 12th April 1959 [*see A.B.A.*, 26, No. 2155]. Over a laying period of approx. 14½ mths., with no culling, Australorps averaged 232.1 eggs on a hen/day basis, White Leghorns 262.4 eggs, and the test average was 243.3 eggs. Adult mortality averaged 14.5%. These results are considered remarkably good and should provide basic information on the relative value of top Victorian purebred strains. (Animal Breeding Abstracts)

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The Ministry of Agriculture and Fisheries, 3 Whitehall Place, London S.W.1

GERMANY
Landwirtschaftskammer Westfalen und Lippe Abtl. Tierzucht, Postfach 342, Münster (Westfalen)
Ministerium für Ernährung, Landwirtschaft und Forsten, Rossstrasse 135, Düsseldorf

INDIA
The Government of India, (The High Commission of India, Political Dept., India House, Aldwych, London W C 2, England)

MEXICO
Secretaria de Agricultura y Ganaderia, Tacuba 7, Mexico, D.F.

NORTHERN IRELAND
Ministry of Agriculture, The Secretary, Stormont, Belfast

SCOTLAND
Department of Agriculture, St. Andrew's House, Edinburgh 1

UNION OF SOUTH AFRICA
Administrative Secretary, Office of the High Commissioner for the Union of South Africa, South Africa House, Trafalgar Square, London W. C. 2, England

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L. W. Jacobs, 131 Vimiera Road, Eastwood, N. S. W.
J. W. Twyford, 2 Auld Avenue, Eastwood, N. S. W.
J. D. Wetherall, 64 Wrights Road, Drummoyne, N. S. W.

BELGIUM

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Etienne Meirhaeghe, Stationstraat 59, Gavere
Jan Van Looveren, Heikaustraat 114, Kalmthout

BRAZIL

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Miss M. C. French, British Oil & Cake Mills Demonstration Farm, Risborough Road, Stoke Mandeville, Bucks.
M. H. Fussell, British Oil & Cake Mills Ltd., 2 Kingscote Street, London, E. C. 4
S. K. Hart, Raby Cottage, Hardendale, Shap, Penrith, Cumberland
Miss Kathleen M. Herron, At Brookfield House, Wycombe Road, Princes Risborough, Bucks.
J. C. Holton, Ixworth House, 19 Maffit Road, Ailsworth, Peterborough, Northants.
G. R. Horden, Linnet Lodge, The Grove, Market Drayton, Shropshire
Dennis G. Howell, Glaxo Laboratories Ltd., Greenford, Middlesex
Richard A. Hughes, British Oil & Cake Mills Demonstration Farm, Risborough Road, Stoke Mandeville, Bucks.
D. R. Illman, Harper Adams Agricultural College, Newport, Shropshire
Miss Lottie C. Innes, British Oil & Cake Mills Demonstration Farm, Risborough Road, Stoke Mandeville, Bucks.
W. F. Jaffe, University of Bristol Veterinary Laboratories, Langford House, Langford, nr. Bristol
S. A. Keeble, Glaxo Laboratories Ltd., Greenford, Middlesex
J. Kilduff, 23 Piercy Street, Failsworth, Manchester
Miss Elsie F. King, British Oil & Cake Mills Ltd., P. O. Box 2, Barlby Farm, Selby, Yorks.

G. N. Lilley, Yardley Chase, Yardley Hastings, Northampton
J. L. Ling, 103 Moss Lane, Bramhall, Stockport, Cheshire
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A. C. A. Macnab, Westbourne House, Church Street, Histon, Cambridge
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Robert D. Murray, Croft House, 108 Bexwell Road, Dunham Market, Norfolk
Eric Mussellwhite, Woolsey Farm, Old Catton, Norwich, Norfolk
Mrs. Mary Mussellwhite, Woolley Farm, Old Catton, Norwich, Norfolk
Miss A. G. Newham, 6 Brooklands Avenue, Cambridge
J. Nicholls, "Nyanja", Trustthorpe Road, Sutton-on-Sea, Lincs.
P. A. H. Nock, Neata Farms Ltd., Ireley Road, Winchcombe, Cheltenham, Gloucester
Peter Openshaw, 6 Birchwood Road, Maidstone, Kent
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J. P. Quick, Sterling Poultry Products Ltd., Bartons, Exeter Road, Okehamton, Devon
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Mrs. D. I. S. Richardson, Agricultural Economics Department, The University, Manchester 13
Harold Robinson, Danum House, Tollerton, York.
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Lewis Willacy, British Oil & Cake Mills Demonstration Farm, Risborough Road, Stoke Mandeville, Bucks.
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R. A. Wright, Houghton Poultry Research Station, Houghton, Huntingdonshire

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Tovio Jaujiainen, Siipikarjanhoitajain Tiitto, Hämeelinna
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Sul Ha Chi, Central Livestock Experiment Station, Sungwhan, Chungnam Province

Sang Churl Kim, Whasam Livestock Experiment Station, Suwon
Tong Kun Kim, Central Livestock Experiment Station, Sungwhan, Chungnam Province
Chai Keun Lee, Department of Animal Science, College of Agriculture, Chungbuck University, Chungbuck Province
Keun Sang Lee, Taichon Livestock Experiment Station, Yusong, Chungnam Province
Se Chong Ohh, Taichon Livestock Experiment Station, Yusong, Chungnam Province
Son Keun Ohh, Department of Animal Science, College of Agriculture, Chungbuck University, Chungbuck Province
Seung Kyu Rhee, College of Agriculture, Seoul National University, Suwon
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Anwar M. Baluch, P. O. Box 4883, Karachi
G. H. Bana, Livestock Development Corporation, P. O. Box 4883, Karachi
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Nikolai S. Nekhotyashchy, ul. Kreschatik 24, Kyev
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WEST INDIES

F. Agénor, Haut de Turgeau, Debussy No. 6, Port-au-Prince, Haiti
Station Experimentale National Avicole, Dept. Agric., Resources Naturelles et du Developpment Rural, Damien, Haiti

ADDRESS CHANGES

(Received from March 15 through July 1, 1960)

AUSTRALIA

S. C. Chapman, 22-24 Thurlow Street, New Market, Queensland

BELGIUM

L. Geurden, Everstraat 23, St. Amandsberg
N. V. Hens, 9c Wasserijstraat, Schoten
A. Levrau, Statiestraat 66, Olsene
M. J. J. Puype, Luikse Steenweg 261, Hasselt
Franz Van Dooren, 24 Van Eijcklei, Antwerpen

ENGLAND

Albert E. Beer, Kingston House, St. Julian's Friars, Shrewsbury, Shropshire
F. Cumber, 9-11, The Quadrant, Richmond, Surrey
A. C. Coutts, B.O.C.M. Ltd., 6 Redcliffe Parade West, Bristol 1
W. Gardner, Wyreside, Wyresdale, Lancs.
Miss Catherine M. Hooper, Swan Cottage, Martyr Worthy, Winchester, Hants.
Miss V. M. Lloyd-Jones, AEC Offices, Bitts Park, Carlisle, Cumberland
Alexander King, The Ministry of Agriculture, Chalfont Drive, Nottingham
Miss M. E. Lambert, c/o 50, Priory Road, Bicknacre, Chelmsford, Essex
David Pollicott, Government Bldgs., Marston Road, Oxford
Colin J. Smith, Philwyn, Priory Road, Forest Row, Sussex
J. Spenceley, 23 Higher Lane, Lymm, Cheshire

Miss E. W. Stanger, c/o 28, Bulmershe Road, Reading, Berkshire (LIFE MEMBER)
Gerald Watts, 58 Gladstone Road, Chester, Cheshire

GERMANY

Frau J. Gylstorff, Institut für Tierhygiene, Hans-Böckler-allee 16, Hannover
W. Koch, Berlinerstr. 1, Munchen 23

GHANA

H. K. Agbettor, Ministry of Food & Agriculture, P.O. Box 891, Kumasi
F. D. Wharton, Jr., P. O. Box 97, c/o Animal Health Station, Pong Tamale, Tamale

ISRAEL

A. Livshutz, Arlosoroff Street 104, Tel-Aviv

JAPAN

Masaharu Tauchi, Kumamoto Livestock Breeding Farm, Nishigoshi-mura, Kikuchi-gun, Kumamoto-ken

NETHERLANDS

J. A. De Bas, 9A, Parkweg, 8 s-Gravenhage
W. F. Van Tijen, 204 Kroostwegm, Zeist

NEW ZEALAND

G. J. ten Hove, "Salland", Kennedy's Bush Road, Halswell

NORWAY

Arne Eskilt, Pilesdretet 57, Oslo dep.
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SWEDEN

Iwar Dawidson, A. B. Gotlandsprodukter, Visby
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U. S. A.

G. M. Briggs, Department of Nutrition & Home Economics, University of California, Davis, Calif.
Lee W. Herrick, Box 124, Northfield, N. J. (LIFE MEMBER)
Burt Heywang, 5827 Bethany Home Road, Glendale, Arizona
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D. N. Roy, c/o Dr. Nathan S. Hall, UT-AEC Agricultural, P.O. Box 142, Oak Ridge, Tenn.
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Mikhail N. Bogandov, Nagatinskoye shosse 14, kv. 65, Moscow
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WALES

S. Jackson, National Agricultural Advisory Service, Transcoed, Aberystwyth

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Dr. von Burgsdorff—A Member of Council of The World's Poultry Science Association for many years. He participated in Congresses held in London, Rome, Leipsig, Paris and Denmark. Dr. von Burgsdorff occupied a prominent place in German Poultry Organizations and was very active in international poultry affairs.

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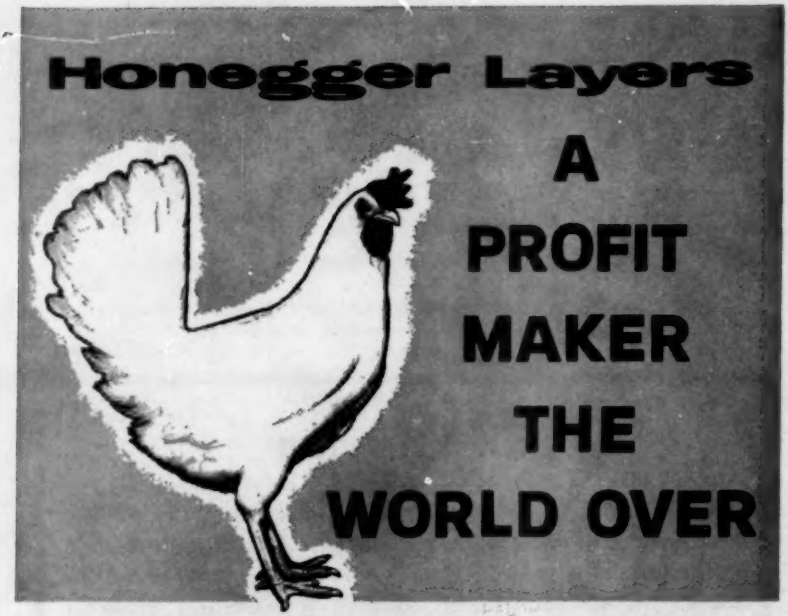

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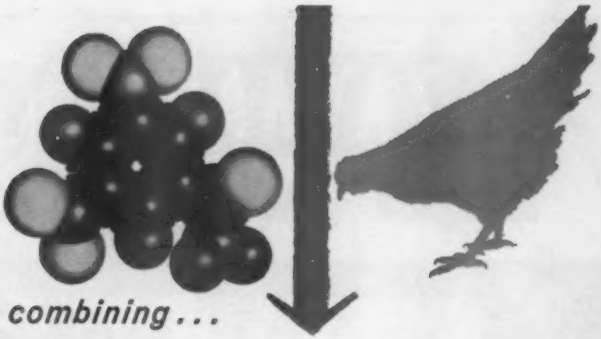

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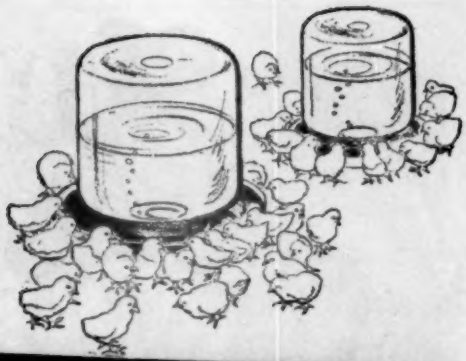

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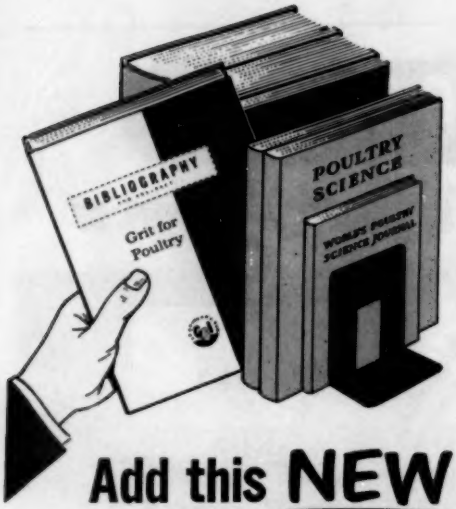

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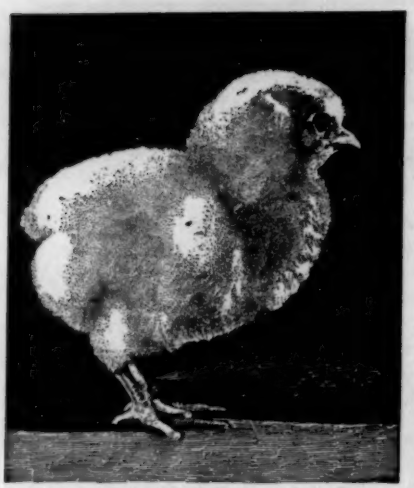

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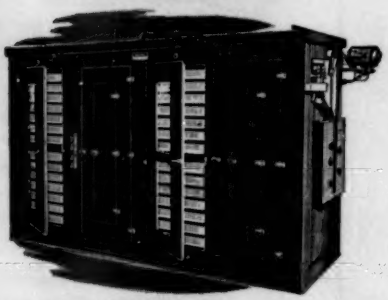

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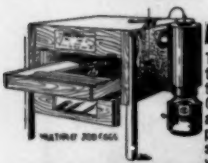

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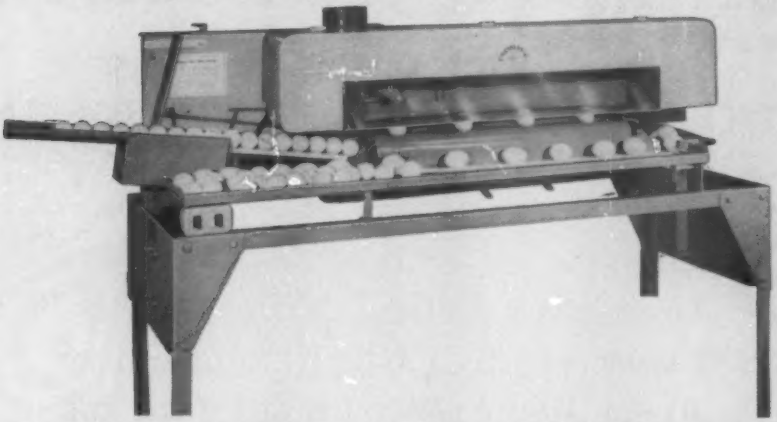

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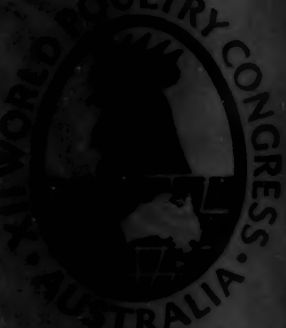

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